RUSS OLSON VOLUME 13

EQUIPMENT

Description

Trucks, Motors and Controllers, Truck Identification, Traction Motors, Car Weights

Sub-divisions Within This Volume

- Contents of Front pocket
- Trucks, Motors, & Controllers
- Truck Identification
- Traction Motors
- Car Weights
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CONTENTS OF
FRONT POCKET

Minneapolis Tribune
July 8, 1899

After the new electric line to Stillwater is in operation the road to the penitentiary will be so easy, and traveling will be so luxurious that the population of that resort may be expected to increase at an unheard of ratio.

The good broad highway which leads to ruin is a rough and thorny by-path compared to the king's highway which is now under construction between the Twin Cities and Stillwater.

The Tribune has told of the general excellence of the road bed, which is fully up to all the requirements of modern interurban traffic, but the cars which the company is building for the Stillwater service are far and away ahead of anything the company ever attempted to place on wheels.

There never were such cars in all the Northwest as the Twin City Rapid Transit Co. is building in its shops at Thirty-first street. There are 20 cars all told, 10 of them motor cars, each with four powerful motors, just twice as many as the regular interurban cars carry, and 10 trailers. The trains, therefore, will be made up of two cars, a motor and a trailer.

Besides being equipped with all the attachments which have rendered the old cars models of elegance and comfort, the new ones will possess many which have not been in use in this part of the country, if anywhere else. Each motor car will be supplied with air brakes. The trains will run at high speed, often attaining 40 miles an hour, and with the momentum acquired by such fast running the motorman would be powerless to control his train with nothing better than the ordinary hand brake.

The air brake will be practically the same as those in use on steam roads. The compressing air pump will be run by a small motor, under control of the motorman. The brake will be operated by mechanism similar to that of the Westinghouse brake.

An air whistle will be another of the new appliances. The air chamber will be supplied with a whistle similar to the smaller steam whistles, and the whistle will be used to sound warnings at country road crossings. The ordinary stret car gong will be used within the limits of the cities.

But the most advanced bit of mechanism with which these new palace cars will be equipped is a complete system of telephonic communication with the main office. As the new line is a cross country line, there will be miles of open country between stations. Although accidents to motors and cars are comparatively rare they are liable to occur, and if they should occur when the cars are miles out in the country, it is important that the motorman should be able to communicate quickly with the home office.

For that purpose each car is supplied with a telephone placed in the front vestibule. The 'phones are nicely adjusted by springs so the jolting of the car will not destroy the delicacy or impair the efficiency of the instruments. At the feed poles, which are placed a quarter of a mile apart, the motorman can "plug" in his telephone and open communication with the head office. In case a train is disabled or snowed in, the main office can be advised of the condition and relief dispatched.

The telephone will also be useful in arranging passing points for the cars if it should be necessary to do so.

[Never Happened!]

Minneapolis Tribune (1867-1908); Mar 28, 1901;
ProQuest Historical Newspapers: Minneapolis Tribune (1867-1922)
pg. 7

CAN'T DO IT

General Manager Hield, of the Street Railway Co., Talks to the Aldermen.

Explains Why Certain Orders Regarding New Cars Cannot Be Obeyed.

W. J. Hield, general manager of the Twin City Rapid Transit company, had an interesting session with the council committee on railroads yesterday afternoon.

The committee ordered him to put big cars on the Bloomington avenue line, and to decrease the time limit between the cars on the Western avenue and Second street northbeast; on the Lyndale avenue and Monroe street, and on the Hennepin avenue to Thirty-first street lines.

And then, when he suavely told the committee he would find it impossible to do these things because the company had not the cars wherewith to do them, the committee very carefully explained that it did *not really mean it, but that the orders* issued to him by the city council merely meant that it would like to have him do things as soon as he could.

MAKES AN EXPLANATION.

Then the genial manager entered into an explanation of how some things were done, and why some things are not done.

"I don't know that the information will interest you," said Mr. Hield, "but it is a fact that every big car that rolls by this city hall represents $6,000 in cold cash, and we have to stop and think some before we build a flock of them.

"But there are now over 100 car bodies lying in the shops, where they have been waiting, some of them 90 days, for the motors and trucks, which have just begun to arrive this morning.

"As soon as these big cars are mounted they will be put out; but I cannot promise that they will be put on the Bloomington avenue line, for I don't know where they will go, and as for increasing the number of cars on the other lines, I could not do it at this time if you had a warrant out for me, because we are using every bit of rolling stock we have.

TREATED PRETTY NICE.

"And at that Minneapolis is being better treated than St. Paul, which has but one well equipped line, the Selby, while Minneapolis has the Camden Place-Washburn Park, the Eighth and Central, and the Hennepin and Twentieth lines of big cars, to say nothing of the two interurban lines. And all the 100 big cars waiting for wheels and motors will be used in Minneapolis.

"But it will be 60 days before any change for the better is made, and I agree with you that at certain times in the day the cars on some lines are greatly congested, but we are just as anxious to overcome this difficulty as you are."

TRUCKS, MOTORS
& CONTROLLERS

Diagram of Weight Distribution on Car Axles
Tracing Dated 9-13-1899

(Listed in the sequence the diagrams appeared on the tracing.)

		Weight
TCRT Vestibuled Car	Brill Trucks-Four Motors	
#771 Carbody		18,000
Air brakes and equipment		3,456
4 GE 57 Motors		11,888
2 Brill Trucks		12,656
		46,000
TCRT Vestibuled Car	Brill Trucks-Two Motors	
#771 Carbody		18,000
Air brakes and equipment		3,456
2 GE 57 Motors		5,944
2 Brill Trucks		12,656
		40,056
American Vestibuled Car	Bemis Maximum Trucks-Two Motors	
Carbody		16,400
2 WP Motors		5,368
2 Bemis Trucks		9,232
		31,000
Large Snow Plow	Bemis Trucks 7.5' wheelbase-Four Motor Equipment	
Weight on front truck		34,000
Weight on rear truck		31,170
		65,170
Small Snow Plow	Bemis Truck 5.5' wheelbase-Four Motor Equipment	
Weight equally distributed		44,000
Duluth-Superior TCRT Co's. Car	Brill Truck 5.8' wheelbase-Four Motors	
Carbody and equipment		18,000
4 GE 67 Motors		9,540
2 Brill Trucks		12,140
		39,680

Comments on the Diagram of
Weight Distribution dated 9-13-1899

Minneapolis Tribune July 8, 1899: "There never were such cars in all the northwest as the TCRT Co. is building in its shops at 31st Street. There are 20 cars all told, 10 of them motor cars, each with four powerful motors, just twice as many as the regular Interurban cars carry, and 10 trailers. The trains therefore will be made up of two cars, a motor and a trailer." "Each motor car will be supplied with airbrakes."

Ammerican Street Railway Investments Manual 1900: TCRT Co. information as of March 1900 for the Minneapolis & St.Paul Suburban Railway has this statement: "...20 44 ft. cars running on the line between St.Paul and Stillwater and five smaller cars on local lines in Stillwater."

TCRT VESTIBULED CAR BRILL TRUCKS-FOUR MOTORS (Air Brakes)
This type of equipment was currently commercially available.

TCRT VESTIBULED CAR BRILL TRUCKS-TWO MOTORS (Air Brakes)
No other reference found for such cars with air brakes. Note there is no Diagram for such cars without air brakes. Some Bemis trucks did receive 2 GE 57/K-11 equipment.

Car Wiring Diagrams

G59#3 3-11-1899 Two G.E. 57 Motors and K-11 Control
40 ft. Vestibuled Car: one motor on each truck

AMERICAN VESTIBULED CAR would be 607-626 as originally equipped.

LARGE AND SMALL SNOW PLOW diagrams could be original or added later.

DULUTH-SUPERIOR TCRT CO'S CAR diagram would have to been added in late 1900, probably November or December. The first cars arrived in Duluth in early January 1901. May have been added to the drawing as this was the new TCRT equipment standard.

Using the foregoing figures we can arrive at the weights of the first cars built.

TCRT VESTIBULED CAR BEMIS TRUCKS-TWO MOTORS [737-772]	Weight
#771 Carbody	18,000
2 WP Motors	5,368
2 Bemis Trucks	9,232
	32,600

Data on Car Equipment
Tracing Dated 5-23-1901

[Listed in the sequence the information appeared on the tracing]

	Body	Motors	Trucks	Total
42′6″ American Vestibuled Brill Old 5′8″/4 WP50/K-6	17375	12112	12140	41627
42′6″ American Vestibuled Rebuilt Brill Old 5′8″/4 WP 50/K-6	17250	12112	12140	41502
43′2 ½″ TCRT 1899 Pattern Air brakes TCRT C.B. 5′0″/4 GE 57/K-14	22236	12320	12164	46720
43′2 ½″ TCRT 1899 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	20226	9540	12164	41930
43′2 ½″ TCRT 1899 Pattern Brill Old C.B. 5′8″/4 WP 50/K-6	19348	12112	12140	43600
43′2 ½″ TCRT 1900 Pattern Brill New 5′8″/4 GE 67/K-6	19338	9540	11492	40370
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	18050	9540	12004	39594
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 WP 50/K-6	18050	12112	12004	42166
37′5″ TCRT 1901 Pattern Bemis 5′1″/2 WP 50/TH	15250	5686	9564	30500
37′5″ TCRT 1901 Pattern Bemis 5′2″/2 GE 57/K-11	15342	6160	9564	31066
41′7″ American Open (both motors on rear truck) Bemis M.T. 5′2″/2 WP 50/TH	11250	5686	9564	26500
37′0″ Northern Open (both motors on front truck) Bemis M.T. 5′2″/2 WP 50/TH	10550	5686	9564	25800
43′2 ½″ TCRT 1899 Pattern Brill New C.B. 5′8″/4 GE 67/K-6	20858	9540	11492	41890
"Jumbo" Snow Plow Bemis C.B./4 WP 50/TH				64500
42′6″ American Vestibuled Brill Old C.B. 5′8″/4 WP 50/K-6	17300	12112	12140	41702
43′2 ½″ TCRT 1899 Pattern Air brakes TCRT C.B. 5′0″/4 GE 57/K-6 [sic]		[no weights listed]		
43′2 ½″ TCRT 1899 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	20070	9540	12164	41914
43′2 ½″ TCRT 1899 Pattern Brill Old C.B. 5′8″/4 WP 50/K-6	20070	12112	12140	44462
43′2 ½″ TCRT 1899 Pattern Brill New C.B. 5′8″/4 GE 67/K-6	20070	9540	11492	41242
43′2 ½″ TCRT 1900 Pattern Brill New C.B. 5′8″/4 GE 67/K-6	19270	9540	11492	40442
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	19270	9540	12164	41114
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 WP 50/K-6	19270	12112	12164	43686

Comments on the Data on Car Equipment
Tracing dated 5-23-1901

From the data on the tracing it appears that additions were made without changing the tracing date or listing revision dates. Car numbers were not listed. The following is a summary.

American Vestibuled	607-609,613,615,617,618,620,623,626	10 cars
American Vestibuled Rebuilt [1901]	610-612,614,616,619,621,622,624,625	10 cars
TCRT 1899 Pattern	737-788	52 cars
TCRT 1900 Pattern	797-867	71 cars
TCRT 1901 Pattern	868-899	32 cars

American Vestibuled Cars, first two categories: Conflict; although both categories are listed with Brill Old trucks, so are some TCRT 1899 Pattern cars; all three categories could not have these trucks at the same time as there were only 20 sets available.

The next eight categories are TCRT Pattern 1899,1900,1901 cars. The following two categories cover the double-truck Open cars built by American and Northern.

The thirteenth category, TCRT 1899 Pattern cars, apparently pertains to 752-761, 10 cars, which were upgraded much later in 1901. Must have been added later to the tracing.

The Jumbo Snow Plow (one car) follows, another later addition to the tracing.

The last eight categories are the results of re-weighing all the cars. Adding the individual weights across each row (41,552; no weight listed; 41,774; 44,322; 41,102; 40,302; 40,974; 43,546) does not agree with the total weight The difference is 150 lbs. on the American Vestibuled Cars and 140 lbs. on the TCRT Pattern Cars. This is the weight of scrapers which were added to the front trucks during 1901. Also note the Carbody weights have changed. This may be due to the hot water heaters being relocated from the carbody to the motorman's cab, also during 1901.

Another conflict: the Car Wiring Diagram dated 3-13-1901 for K-6 Control and 4 G.E.WP Motors contains a **later notation** "Cars wired like G.E. Co's diagram: 775-788". The Data on Car Equipment tracing dated 5-23-1901 does NOT have category under TCRT 1899 Pattern for TCRT C.B./4 WP 50/K-6 equipment. In addition this range of numbers may include the seven Stillwater Division cars.

TRUCKS, MOTORS, CONTROLLERS
1898 - 1938

Introduction

The subject of changing trucks, motors and controllers is presented on ERofM pages 294-297 and Supplement pages 93-95. Since that time many early photographs have been located which provide additional details not previously known. I had not previously studied and analyzed in depth all this information. I have undertaken such a project with the results presented on the following pages.

Abbreviations used.

Trucks:	
Brill Old	Brill 27-A1 trucks purchased in 1899.
Brill 01, Brill 02, Brill 03	Brill 27-A2 trucks purchased in 1901,1902 and 1903.
Brill 04	Brill 27-E2 trucks purchased in 1904.
Bemis	Bemis 29, both Maximum Traction and Center Bearing.
BLW	Baldwin Locomotive Works
TC	Twin City
Motors:	
WP50	General Electric W. P. 50
GE	General Electric

Controllers:

TH Thomson-Houston rheostatic control, mounted in one enclosure on the front platform. (Includes series-parallel improvement developed 1895.)

1898

New Building

1 car	Private Car	May	Bemis/2 WP50/TH
2 cars	737-738	May?	Bemis/2 WP50/TH
20 cars	739-758	Sep-Dec	Bemis/2 WP50/TH (Como-Interurban-Harriet line)
14 cars	759-772	1-1-1899	Bemis/2 WP50/TH (8th Ave. S. & Central and Selby Ave. lines)

The first 23 sets of equipment were probably purchased new. The following 14 sets probably came from 14 Open Cars 555-568 being placed in winter storage or being retired (gone by summer 1901).

1899

New Building

16 cars	773-788	Jun-Sep	See Equipment Changes
1 car	797	Sep	Bemis/2 WP50/TH

Twenty cars had been ordered, 797-816. Wood parts were made and assembled. Metal parts, trucks and motors could not be obtained. This one car, 797, was "completed using spare equipment".

Equipment Changes

References:

Photos: ERofM page 123 at the 31st St. Shops 1899, 738 with Brill Old and 751 with Bemis trucks; 738 in Sightseer service with Brill Old/2 WP50/TH; 766 (Como-Interurban-Harriet line) on Lake Harriet Loop 1901 with Brill Old/2 WP50/TH.

Street Railway Review article 2-15-1899:"The trucks to be used under these cars have not been decided upon; one of the new cars is now in service with Brill trucks."

The Stillwater line opened 8-23-1899 "with the same type of car as used on the Como-Interurban-Harriet line". (752-758?) On 8-28-1899 "tried new cars with GE57 motors and air brakes which gave the best satisfaction". Apparently the seven Stillwater Division cars received Brill Old/4 GE57/K-14 and air brakes.

Apparently 20 sets of Brill Old trucks were purchased. Appears that one set was installed on the Private Car (see below), seven sets on the Stillwater Division cars (Brill Old,4 GE57/K-14 with air brakes, two sets on 737-738, and 10 sets on other 1898-1899 built cars.

The Private Car was upgraded 7-17-1899: Brill Old/4 GE57/K-14 (air brakes?) Made the first trip over the entire Stillwater line 8-21-1899. Its former equipment could be the "spare equipment" that allowed new car 797 to be completed.

Uncertain if the Bemis/2 WP50/TH on 759-772 were returned to Open Cars 555-568.

789-796 received Bemis trucks, either now or during 1901.

1900

New Building

19 cars	798-816	Jun-Aug	TC/2 WP50/TH
15 cars	817-831	Jul-Aug	TC/2 WP50/TH
28 cars	832-859	Aug-Oct	TC/2 WP50/TH

A total of 72 sets of Twin City trucks were built according to the construction journals. Apparently this was TCRT's solution to a shortage of trucks and motors during 1899-1900. The WP50 motors were purchased used and later rebuilt. The first expenditures for rebuilding these motors were recorded in January 1901.

833-844 under construction during August-September were selected August 27th to become Duluth St. Ry. 151-162. They were not immediately shipped to Duluth as DSR had to rebuild certain tracks to sustain the greater weight, and build wyes and a loop. The first cars arrived in Duluth January 3, 1901. The TC/2 WP50/TH equipment had been replaced with Brill 01/4 GE67/K-6.

Cars 832,845-859 also received Brill 01/4 GE67/K-6 at this time. The Twin City trucks from these 28 cars were used on the 1901 equipment upgrading program. The 3-1-1902 SRJ reported TCRT's standard equipment was Brill 27-A trucks with four GE 67 motors. Additional 4 GE67/K-6 equipment must have been purchased in late 1900 as well as 1901.

1901

New Building

20 cars	2nd833-844; 860-867	Apr	Brill 01/4 GE67/K-6
32 cars	868-899	Feb-Sep	See Equipment Changes

Equipment Upgrading

References:

TCRT's Annual Financial Report for 1901 stated that "Equipment was increased on forty 44-foot cars."

1901 photo of car 777 on ERM page 247 with Brill 01 trucks (with scrapers)but no K-6 controller. (Como-Interurban-Harriet and Minnehaha Falls destination signs.)

Work Orders; the date is when expenditures were first recorded.
  January: Wire and mount suburban cars with Twin City trucks.
  February: Mount 40 Twin City trucks [sic] with GE57 and WP50 motors.
  November: Equip Minnehaha cars with GE57 motors.
  December: Change trucks [Bemis] on 37ft. cars for four motors.

Work Orders for the Interurban cars:
  January: Overhaul Interurban cars; wire and mount cars for three and four motors.
  May: Rebuild Bemis trucks.
  September 1901: overhaul and revarnish 21 [sic] Interurban cars.

Equipment Changes

The Private Car received Brill 01 trucks.

732-735 were listed with Bemis/2 GE57/K-11.

608-626 The January 1901 reference to wire and mount these cars for three and four motors seems to involve the W.P.50 three-motor equipment purchased 3-20-1894. However the Work Order of March 1902 indicates these cars were re-wired from two motors to four motors which is confirmed by the Data on Car Equipment tracing 5-23-1901. I will assume the latter is correct with the work performed during 1902.

Twin City trucks from 832,1st833-844, and 845-859 (28 cars) were transferred to 28 other cars, probably 758-785. (Cost of Cars to 4-15-1908).

The major problem is lack of specific information on cars 737-788 for 1899-1900-1901 and 797-816 for 1900-1901.

Another problem is what cars were assigned to the Stillwater Division 1899-1902. Were they the same seven cars or were changes made, and when? Did the 1902 trial of GE 73 motors involve the same seven cars, or seven different cars? 779-785 are known for certain to have been Stillwater Division cars.

752-757 received Brill 01/4 GE67/K-6 in late 1901. (Cost of Cars to 4-15-1908)

This seems to be the end result of these changes:

608-626	Brill Old/4 WP50/K-6	(1902)
737-751	Brill Old/4 WP50/K-6	(until 1902)
752-757	Brill 01/4 GE67/K-6	(see the foregoing)
758-778	TC/4 GE67/K-6	
779-785	TC/4 GE57/K-14	(Stillwater Division cars) (When?)
786-788	TC/4 GE67/K-6	
797	TC/4 GE67/K-6	
798-816	TC/4 GE67/K-6	
817-831	TC/4 WP50/K-6	
832-867	Brill 01/4 GE67/K-6	
868-899	Bemis/2 WP50/TH and Bemis/2 GE57/K-11 from the older cars being upgraded.	

During 1901 scrapers were installed on the front trucks of 52 cars, 737-788. The front trucks of all new cars were fitted with scrapers.

1902

New Building

50 cars	900-949	May-Nov	Brill 02/4 GE67/K-6

These cars were assigned to the Como-Harriet and Interurban lines replacing the previously assigned cars.

Equipment Changes

20 cars	607-626	Brill Old/4 WP50/K-6
15 cars	737-751	Brill 02/4 WP50/K-6

Work Orders pertaining to American-built cars 607-626:

Mar 02	Rewire 19 American cars from two to four circuits. (This indicates 607 was Wrecked between Sep 01 and Mar 02.)
Aug 02	Repaint and repair two American cars 618 and 623.
Nov 02	Equip 618 and 623 with GE 57 motors geared equal to the same motors on 868-899.

GE 73 motors were tried on the Stillwater Division cars. Expenditures for changing motor leads, wheels and axles on seven cars were incurred from January through July 1902. The motors were paid for in April and May but returned to GE in June.

1903

New Building

42 cars	950-991	Apr-Sep	Brill 03/4 GE67/K-6

Equipment Changes

Work Order Jul 03: dismount and change cars with Twin City trucks. No other information. (773-778 4 GE57/K-14 for the Stillwater Division?)

1904

New Building

50 cars	992-1041	Apr-Jul	Brill 04/4 GE70/K-28	
1 car	1092	Jul	Brill 04/4 GE57/K-??	Experimental Double Deck

Equipment Changes

Sep-Nov: work orders provided for rebuilding, rewiring, remounting, installing air brakes and repainting 868-899.

Nov: Bemis trucks from 874 went on Supply Car 2 (rebuilt from SPCR 540 in May 03) replacing the original McGuire 20 trucks.

32 cars, 908-939, received new BLW 1/4 GE70/K-28. Original equipment went on 868-899.

Work Order Jul 04: standardize 19 [sets] of old Brill trucks and WP50 motors. (608-626)

36 Open Cars, 540-547,549-551,707-731, received K-11 controllers.

1905

New Building

69 cars	1042-1091,1093-1111	Nov 04-Jun 05	BLW 1/4 GE70/K-28
12 cars	1112-1123	Aug	BLW2/4 GE73/C-6-K
21 cars	1124-1144	Sep-Nov	BLW 1/4 GE70/K-28-A

Equipment Changes

13 cars, 905-907,940-949, received new BLW 1/4 GE70/K-28. Their Brill 02 trucks went on 6 cars, 752-757, whose Brill 01 trucks probably became spare equipment.

1092 received BLW1/4 GE70/K-28. The Private Car received Type M Control with C-6 controller.

732 and 734 each received 2 WP50 motors in April. This probably involved 733 and 735 as well as the Record Card for 733 was replaced in Dec 06, and there is no Record Card for 735.

The status at the end of 1905 was

608-626	Brill Old/4 WP50/K-6
Private	Brill 01/4 GE57/C-6
737-751	Brill 02/4 WP50/K-6
752-757	Brill 02/4 GE67/K-6
758-772	Twin City/4 GE67/K-6
773-785	Twin City/4 GE57/K-14
786-788,797-816	Twin City/4 GE67/K-6
817-831	Twin City/4 WP50/K-6
832-867	Brill 01/4 GE67/K-6
868-899,900-904	Brill 02/4 GE67/K-6
905-949	BLW1/4 GE70/K-28
950-991	Brill 03/4 GE67/K-6

992-1041	Brill 04/4 GE70/K-28
1042-1111	BLW1/4 GE70/K-28
1112-1123	BLW2/4 GE73/C-6
1124-1144	BLW1/4 GE70/K-28-A

1906

New Building

1 car	1145	May	BLW2/4 GE73/C-6-K	Double Deck
50 cars	1146-1195	May-Aug	BLW3/4 GE87/C-38	
25 cars	1196-1220	Sep-Dec	BLW5/4 GE70/K-28-B	

52 sets of GE 87 motors and 104 Baldwin #3 trucks were paid for in December 1906. (The practice as of 1906 was to have available two extra trucks with motors for each 25 cars.)

Equipment Changes

733 Bemis/4 GE70/K-28 in Dec for the South Stillwater line.

1907

New Building

25 cars	1221-1245	Feb-Apr	BLW5/4 GE70/K-28-B	
20 cars	1246-1265	May-Aug	BLW5/4 GE70/K-28-B	1246-1259
			BLW4/4 GE73/C-6-K	1260-1265
25 cars	1266-1290	Sep-Nov	BLW5/4 GE70/K-28-B	

Six sets of GE 73 motors were purchased in July for 1260-1265. Five sets of GE 87 motors were purchased in April and mounted on five extra trucks during November-December. One set of Baldwin #3 trucks with GE 87 motors was sold to Duluth St. Ry. in December.

1908

New Building

19 cars	1291-1309	Mar-Aug	BLW5/4 GE213/K-37-A
50 cars	1310-1359	Nov 08-Mar 09	TC5/4 GE213/K-37-A

Experimental work on a mechanical reverse for Type M control was undertaken on car 1264 in October 1907. This proved successful so in March 1908 68 cars were to be so equipped: 1112-1123,1145-1195,1260-1263,1265.

1909

New Building

10 cars	1360-1369	Jul-Aug	TC5/4 GE213/K-37
10 cars	1370-1379	Jul-Aug	TC6/4 GE216/K-37-A

Equipment Changes

773-774 came off the Stillwater Division and received 4 GE67/K-6. 775-785 on the Stillwater Division received K-37 controllers Aug 1909.

950 received BLW1 trucks. 1038-1041 received BLW1 trucks. 1135-1142 received 4 GE67 motors. 1143-1144 received BLW5 trucks. 1288-1290 received BLW5/4 GE213/K-37-A.

The GE87 motors had proved unsatisfactory; they were dismounted, returned to GE, and truck changes made Jun-Nov 1909. Apparently some of the Type M controls were also returned. Thirteen sets of GE73 motors were purchased Jul-Aug 1909.

The changes made were:

18 cars	1146-1163	BLW4/4 GE73/C-6-K	(BLW3 modified)
32 cars	1164-1195	BLW3/4 GE216/K-37	

The BLW3 truck designation subsequently began to lose its distinction, being replaced with the BLW4 designation. After 1912 the BLW3 designation no longer appears.

1909 Truck and Motor List

608-626	Brill Old/WP50
737-751	Brill 02/WP50
752-761	Brill 02/GE67
762-774	TC/GE67
775-785	TC/GE57
786-788	TC/GE67
797-816	TC/GE67
817-831	TC/WP50
832-867	Brill 01/GE67
868-899	Brill 02/GE67
900-904	Brill 02/GE67
905-949	BLW1/GE70
950	BLW1/GE67
951-991	Brill 03/GE67
992-1037	Brill 04/GE70
1038-1107	BLW1/GE70
1112-1123	BLW2/GE73
1124-1134	BLW1/GE70
1135-1142	BLW1/GE67
1143-1144	BLW5/GE70
1145	BLW2/GE73
1146-1163	BLW4/GE73
1164-1195	BLW3/GE216
1196-1259	BLW5/GE70
1260-1265	BLW4/GE73
1266-1287	BLW5/GE70
1288-1309	BLW5/GE213
1310-1369	TC5/GE213
1370-1379	TC6/GE216

1910

New Building

25 cars	1380-1404	Jan-Mar	TC6/4 GE216/K-37-A
20 cars	1405-1424	Apr-Jul	TC6/4 GE216/K-37-A
25 cars	1425-1449	Nov-Dec	TC6/4 GE216/K-37-A

Equipment Changes

775-778 were replaced by 1263-1265 on the Stillwater Division 2-15-1910. The former received 4 GE67/K-6. (EHN: Sep 1909 on 775-777 and 2-15-10 on 778.)

1911

New Building

1 car	1450	Jan	TC6/4 GE216/K-37-A
31 cars	1451-1481	Jan-Feb	TC6/4 GE216/K-37-C

Equipment Changes

1193-1195 BLW3/4 GE70/K-28 Aug. 15th because of a shortage of GE216 motors.

During November an order was issued that 1164-1195 were to be used on pull-outs only, preferably on the inter-city routes. It had been found that because of the heavy bodies (intended for double decking) and the heavy BLW3 trucks, the GE216 motors overheated when the cars were operated in regular service. The cars were later assigned as regular cars on lighter routes.

Photographs indicate Brill 01 trucks were installed on at least 616 and 621 during this time.

1912

New Building

100 cars	1482-1581	Feb-Oct	TC8/4 GE216/K-37-C	1482-1580
			TC8/4 GE203/K-37-C	1581

Equipment Changes

GE203 motors were tested Mar-Apr in 1348 compared to GE213 motors in 1342, and Apr-Jun compared to GE216 in 1422. This set was then placed in 1581, the newest car built.

992-993 were converted to double-end operation in Oct for the E.25th St. line: BLW1/4 GE203/K-28.

1564-1566 were sold in Nov to DSR.

762-763 and 868-869 exchanged trucks. 762-763 received Brill 02 and 868-869 received TC. 868-869 were rebuilt for double-end operation and sold to DSR in Dec.

Late 1912-Early 1913 Equipment Changes

905-946	Brill 03/4 GE67/K-6
947-954	BLW1/4 GE67/K-6
955-975,981-991	BLW1/4 GE70/K-28
1164-1168,1193-1197	BLW1/4 GE70/K-28-A
1189-1192	BLW5/4 GE70/K-28-B
1286-1288	BLW5/4 GE216/K-37-C
1370	TC5/4 GE213/K-37-A
1371-1375	BLW4/4 GE216/K-37
1376-1379	TC5/4 GE216/K-37

1913

New Building

3 cars	1564II-1566II	Apr	TC8/4 GE203/K-37-C
14 cars	1582-1595	Apr-May	TC8/4 GE203/K-37-C
40 cars	1596-1635	May-Oct	TC8/4 GE203/K-37-C

Equipment Changes

782-785 were sold complete.

GE203 motors were adopted for new cars built during 1913. 1564II-1566II received TC8/GE216 from 1578-1580 which in turn received the TC8/GE203 from 1564II-1566II. This was done to have the new cars equipped in numerical order.

GE200 motors were tested during Nov-Dec in 1620 compared to GE203 in 1615 and 1622.

1914

New Building

50 cars	1636-1685	Dec 13-Feb 14	TC8/4 GE203/K-37-C

Equipment Changes

March: 1255-1259 BLW4/4 GE73/C-6

December: 992-993 were converted back to single-end operation. 992 received Brill 02/4 GE70/K-28 while 993 retained the BLW1/4 GE203/K-28.

1915-1917

New Building

90 cars	1686-1775	Oct 14-Feb 15	TC9/4 GE200/K-43-F2

17 cars	1776-1792	Nov-Dec 15	TC9/4 GE200/K-43-F2
2 cars	2000-2000A	Apr 16	TC10/8 GE258/one K-43-F2
59 cars	1793-1851	Nov 16-Feb 17	TC9/4 GE200/K-43-F2
4 cars	1852-1855	Jun 17	TC9/4 GE200/K-43-F2

1713,1716,1719,1722,1724,1789-1792 were sold May/Jul 1916 and their replacements built Nov 1916. 1855 was sold Nov 1917 and not replaced.

1916 Mech. Dept. Data Sheets (before 1836-1855 were completed)

TC/4 WP50/K-6	817-831
TC/4 GE67/K-6	764-780,786-788,797-816
TC/4 GE57/K-14	781 (782-785 were sold in 1913)
Brill01/4 GE67/K-6	832-867
Brill02/4 WP50/K-6	737-751
Brill02/4 GE67/K-6	752-763,870-899,900-904,976-980
Brill03/4 GE67/K-6	905-946
Brill04/4 GE70/K-28	992-1041
BLW1/4 GE70/K-28	955-975,981-991,1042-1107,1164-1168,1193-1197
BLW1/4 GE70/K-28-A	1124-1142
BLW1/4 GE67/K-6	947-954
BLW2/4 GE73/C-6	1112-1123,1145
BLW4/4 GE73/C-6	1146-1163,1255-1265
BLW4/4 GE216/K-37	1169-1188,1371-1375
BLW5/4 GE70/K-28	1143-1144
BLW5/4 GE70/K-28-B	1189-1192,1198-1254,1266-1288
BLW5/4 GE213/K-37-A	1289-1309
TC5/4 GE213/K-37-A	1310-1370
TC5/4 GE216/K-37-A	1376-1379
TC6/4 GE216/K-37-C	1380-1479
TC8/4 GE216/K-37-C	1480-1581
	(separate sheet added for 1578-1581 with GE203 motors)
TC8/4 GE203/K-37-C	1582-1619,1621-1685
TC8/4 GE200/K-43-E	1620
TC9/4 GE200/K-43-F2	1686-1835

Equipment Changes

The MSR Valuation Report dated 1-1-1916 indicates that massive equipment changes were made during this time period. Extensive rehabilitation programs were in progress together with an apparent inability to obtain sufficient quantities of new motors as well as steel for manufacturing new trucks. Newly built cars as well as rehabilitated cars were released from the shops with whatever trucks, motors and controllers were available at that particular time. Only cars assigned to MSR were included with the numbers assigned to various groups. The quantity of each type of truck, motor, and controller on the cars assigned to each group were inventoried and summarized,but not identified by car number. The results were chaotic, nothing like the mechanical dept. data sheets indicated.

The Mech. Dept. data sheets dating to early 1916 show 737-751 with Brill02 trucks and 817-831 with Twin City trucks. The MSR Valuation Report dated 1-1-1916 shows both series of cars with Brill02 trucks. After the 1918 sales to Tacoma the data sheet for 737-751 shows them with Twin City trucks while the data sheet for 817-831 was removed because of the sales. No explanation has been found for the difference.

A memorandum dated 9-5-1917 ordered (1) the installation of GE200 motors on 1574-1577 whose GE 216 motors were to go on 1286-1288 with one set (four motors) as truck shop extras, (2) installation of GE 200 motors on 1685, whose GE 203 motors were to be used as truck shop extras, and (3) one set (four) GE200 motors to be used as truck shop extras.

A memorandum dated 1-1-1918 stated that because of a shortage of trucks and motors cars 1470,1577,1607,1610,1844 were to be placed in storage for the winter.

1919

50 sets of TC9 trucks with GE 200 motors were manufactured during 1918-1919. Six sets were shipped to Duluth St. Ry. in May 1919 for cars 289-294 (ex 1202, 1204, 1212, 1231, 1232, 1234). 44 sets were used on TCRT cars.

1921

The SPCR Valuation Report dated 1-1-1920 was based on the same system used for the MSR valuation, which indicated that the chaotic combinations of trucks, motors and controllers still existed. The joint MSR and SPCR Valuation Report dated 1-1-1922 identified the trucks, motors and controllers on the individual cars, and showed the chaotic conditions had been greatly improved. By this time many of the older cars had been sold or rebuilt to trailers.

TC/4 GE67/K-6	764,780,800-802,806,809,813-816
TC/4 GE57/K-37	781
Brill01/4 GE67/K-6	843,847,854-858,860-867
Brill02/4 GE67/K-6	870-899,900-904,942-943,945-946,976-979
Brill02/4 GE70/K-6	980 (changed 9-5-1917)
Brill02/4 GE70/K-28	992
Brill03/4 GE67/K-6	905-941
Brill04/4 GE70/K-28-A,B	994-1041
BLW1/4 GE67/K-6	947-949
BLW1/4 GE67/K-28-A,B	950-951,953-954
BLW1/4 GE70/K-6	944
BLW1/4 GE70/K-28-A,B	955-975,981-991,1042-1107,1124-1144,1193-1197
BLW1/4 GE203/K-28-A,B	993
BLW2/4 GE73/C-6-K	1112-1123,1145
BLW4/4 GE73/C-6-K	1146-1163,1255-1265
BLW4/4 GE216/K-37	1164-1182,1371-1375
BLW5/4 GE70/K-28-B	1198-1254 (1202,1204,1212,1231,1232,1234 sold) 1266-1286
BLW5/4 GE70/K-37	1183-1192
BLW5/4 GE213/K-37-A	1289-1309
BLW5/4 GE216/	1287 K-28-B, 1288 K-37-A
TC5/4 GE213/K-37-A	1310-1370
TC5/4 GE216/K-37-A	1376-1379
TC5/4 GE216/K-37-C	1475
TC6/4 GE216/K-37-A,C	1380-1474,1476-1479
TC8/4 GE213/K-37-C	1650-1652,1656-1658,1660,1662-1665,1669,1673,1675
TC8/4 GE216/K-37-C	1480-1529,1531-1573,1603-1605,1607,1609,1666-1668, 1670-1672,1674,1676-1684
TC8/4 GE216/K-43-F2	1778-1780,1788
TC8/4 GE203/K-37-C	1575-1602,1606,1608,1610-1649,1653-1655,1659,1661
TC8/4 GE203/K-43-F2	1776-1777
TC8/4 GE200/K-37-C	1574
TC9/4 GE200/K-43-F2	1685-1775,1781-1784,1787,1789-1854
TC9/4 GE200/K-37-C	1530
TC9/4 GE216/K-43-F2	1785-1786

10-29-1926 We have a complete set of Mechanical Dept. data sheets with a label "10-29-1926 A. J. J.". Comparing these with the 1-1-1922 joint Valuation Report the following changes have occurred.

1286-1288	BLW5/4 GE70/K-37-C
1475	TC6/4 GE216/K-37-C
1530	TC8/4 GE216/K-37-C
1574-1577	TC8/4 GE200/K-43-F2
1600-1625	TC9/4 GE200/K-43-F2
1650-1652,1656-1658,1660,1662-1684	TC8/4 GE203/K-37-C
1685	TC8/4 GE200/K-43-F2
1776-1780,1785-1786,1788	TC9/4 GE200/K-43-F2

1928

The rebuilding of 1254,1266-1328 involved extensive equipment changes. The existing equipment was:

1254,1266-1285	BLW5/GE70	21 cars
1286-1288	BLW5/GE216	3 cars
1289-1309	BLW5/GE213	21 cars
1310-1328	TC5/GE213	19 cars
		64 cars
1003-1041	Brill04/GE70	39 cars
1169-1188	BLW4/GE216	20 cars
1371-1375	BLW4/GE216	5 cars
		64 cars
1578-1599	TC8/GE203G	22 cars
1626-1667	TC8/GE203G	42 cars
		64 cars

According to the Construction Journals 70 Brill 04 trucks (35 cars) and 58 BLW4 trucks (29 cars) were scrapped (total 64 cars). (1007-1041 35 cars; 1169-1192,1371-1375 29 cars.) The BLW5/TC5 trucks, now all referred to as TC5 trucks, were intended to go on 1003-1041,1169-1188, and 1371-1375, with the GE70 motors to 1169-1188. Based upon subsequent data sheets and a March 5,1930, Truck and Motor List, this is what actually took place.

1254,1266-1328	64 cars	TC9RB built new/GE203G from 1578-1599, 1626-1667/K-43-F2 (apparently second-hand)
1003-1006	4 cars	BLW1/GE70/K-28
1007-1041	35 cars	TC8/GE70/K-28
1164-1192	29 cars	TC8/GE70/K-28
1371-1375	5 cars	TC8/GE213/K-37
1578-1599,1626-1667	64 cars	TC5/GE216/K-37-C

March 5, 1930 Truck and Motor List

This list indicates the following changes had occurred:

992-993	BLW1/GE70/K-28
1240-1253	BLW5/GE203/K-43-F2
1376-1379	TC5/GE213/K-37-A or C
1574-1577	TC8/GE216/K-43-F2
1668-1684	TC8/GE216/K-37-C
1685	TC8/GE216/K-43-F2

1931

Rebuilt one/two man: 1293-1328,1854 retained existing equipment.

Rebuilt double end (August) 1230: TC8/GE70/two K-28-B. Subsequently two K-37-C.

All cars rebuilt for one/two man operation, now and subsequently, received a G.E. DB987LB Line Breaker and LB-2A Control Device.

1932

Inter-Campus line: 1146-1149,1160 BLW4/GE216/K-37

Rebuilt double end (August): 1129 TC5/GE70/two K-28-B

Rebuilt one-two man for Jackson St. line (September): 1124-1128,1131 BLW1/GE70/K-28-A

1932-1933-1934

Rebuilt one/two man:

TC5/GE213/K-37-C	1382,1384-1398,1402,1408.
TC6/GE216/K-37-C	1415,1417,1420,1424,1425,1430,1433,1437,1440,1441,1446,1448-1451, 1454,1462,1464-1470,1473,1475,1479-1480,1482,1485,1487-1492,1494-1513,1515-1541,1543-1546.
TC8/GE216/K-37-C	1548-1554,1556-1562,1564-1593,1603-1644.
TC8/GE203/K-37-C	1594-1602.
TC9/GE200/K-37	1659-1668.
TC9/GE200/K-43-F2	1645-1658,1669-1854.

1935

Rebuilt one/two man:

1219-1220,1222-1229,1233,1235	TC5/ exchanged GE70 for GE216 from Work Cars 46-49,51-56 /second-hand controllers
1221,1248-1253	TC6 or TC8/GE216/second-hand controllers
1236-1242	TC9/GE200/second-hand controllers
1243-1245	TC9RB/GE203/second-hand controllers
1246-1247	TC5/GE213/second-hand controllers

Another source: all cars TC5/GE213. This agrees with the May 1948 Motor List except that 1244-1245 had GE216 motors.

Second-hand controllers:

K-35-G	1223
K-35-G2	1221,1222,1224,1225,1228,1229,1233,1243,1246-1248
K-35-GR	1237
K-35-GR2	1220,1251,1253
K-35-BB	1219,1226,1235,1240
K-35-HH	1238,1241
K-35-JJ	1239,1242,1245,1249,1250,1252
K-35-KK	1227,1236,1244

A memorandum dated 11-16-1935 covered plans to use "some 30 1100's in winter service". A blueprint listed proposed truck and motor changes involving 35 cars: 1166-1171, 1173-1192 and 1206-1211,1213,1214,1216. All of these cars were repainted except five: 1169,1171,1185-1187. Due to heavy bodies and trucks, some of these were to be changed using 30 sets of trucks from cars being rebuilt one/two man.

	From	To
1169,1183,1188	TC6/GE216	TC8/GE70
1173,1175-1178	TC8/GE216	TC8/GE70
1174	BLW4/GE216	TC8/GE70
1179	TC5/GE213	TC8/GE70
1186	TC5/GE70	TC8/GE70

1170,1171,1180-1182,1184,1185,1187 were already TC8/GE70

1936-1937

On cars 1166-1218 rebuilt one/two man the trucks were rebuilt Twin City #8 with roller bearings. Motors and controllers were purchased second-hand.

1166-1185: "similar equipment" to 1186-1218 series cars. No details. Apparently GE203 motors and K-35 controllers.

1186-1201,1203,1205-1211,1213-1218: nine cars GE203A and 21 cars GE203Q motors.
Controllers;

K-35	1215
K-35-L	1187,1189,1199
K-35-BB	1186,1188,1190-1195,1197,1198,1200,1201,1203,1207,1209,1214,1217
K-35-HH	1218
K-35-Q	1196,1206,1208,1210,1211,1213
K-35-G2	1216
K-35-BB or K-35-Q	1205

1938

1146-1149 Rebuilt with front exits for Inter-Campus line: TC6/GE216/K-43-F2

1942

Rebuilt one/two man: 1487,1490,1491,1500,1516 TC6/GE216/K-37-C

1949

1136 Fair Grounds Office Car: trucks and motors from scrapped 1458 TC6/GE216

LIGHTWEIGHT CARS

2000-2001	1916	TC10/8 GE258/1 K-43-F2 arranged for train control
	1921	TC11
	1928	rebuilt TC12RB/4 GE258/K-75 each car
2002-2003	1921	TC11/8 GE264/1 K-43-F2 arranged for train control
	1923	TC11/4 GE258/K-65 each car
	1928	rebuilt TC12RB/4 GE258/K-65
1-4	1925	TC12/4 GE258/rebuilt K-28 Simplex safety devices
	1932	3 rebuilt double end; addditional rebuilt K-28 controller
	19??	1,2,4 K-75 controller
	1938	Eleven #12 truck frames built in 1925 for cars 1-4 plus three spare trucks were scrapped together with two #11 truck frames which were obsolete. Equipment from cars 1-4 was re-installed in eleven #11 truck frames salvaged from Trailers 200-224. In 1939 forty #11 truck frames formerly under 200-225 were scrapped.
2004-2005	1926	TC12RB/4 GE258/K-67
2006-2030	1928	TC12RB/4 GE258/K-75

SERVICE EQUIPMENT

1916 = MSR Valuation Report January 1, 1916
1920 = SPCR Valuation Report January 1, 1920
1922 = MSR/SPCR joint Valuation Report January 1, 1922

Supply Car 1st 2	May 1903	Rebuilt from SPCR 540: Bemis/4WP50/K-6
		(Nov 1904: Bemis from 874)
	Apr 1912	Brill02/GE67/K-6
Supply Car 2nd 2	Nov 1922	Rebuilt from 762: Brill02/4 GE67/K-6
Work Cars 7-10	Nov 1904	TCWC/WP50/K-6
	Sep 1917	7 and 9 install GE70 motors (WP50 motors to be scrapped).
	1920	10 TCWC/GE70/K-6
	1922	All TCWC/GE70/K-6
	1947	8 TC5/GE213
	1949	7 motors from 1358; 9 trucks/motors from 1379; 10 trucks/motors from 1413; K-37.
Work Cars 11-16	Apr 1905	TCWC/WP50/K-6
	19??	11-12 TCWC/GE57/K-14
	1920	11 TCWC/GE70/K-14; 12 TCWC/GE67/K-14; 16 TCWC/GE70/K-6
	1922	11-12 TCWC/GE57/K-14; 13-16 TCWC/GE70/K-6
	?	11-12 K-37
	1938	13 TC5/GE70
	1947	11 TC5/GE213; 13 TC6/GE216; 15 TC5/GE213
	1949	14 motors from 1486; 16 trucks/motors from 1431; K-37 (TC6 seen on 14)
Wire Cars 3-4	May/Aug 1905	Brill01/?/?
	19??	TC/GE57/K-14 (1916 data sheet)
	1947	All TC6/GE216
Delivery Car 1	Nov 1905	No information on original equipment
	May 1909	Converted to Baggage Car 34 BLW4/GE57/K-14
	1927	Data sheet: K-43 controller
Snow Plow 22	Feb 1906	No information on original equipment. See NOTES
Snow Plow-Sweepers 23-24	Jan 1907	No information on original equipment. See NOTES
Snow Plow 25	Nov 1904	Bemis/GE57/K-14
Work Cars 17-19	Jun-Jul 1907	TCWC/GE70/K-28-B
	1947	17 TC5/GE213
	1949	18 trucks/motors from 1332; 19 trucks/motors from 1471; K-37
Locomotive 20	Aug 1907	BLW4/GE57/K-6
	1916	TCWC/GE57/K-6
	1945	K-37-A
Wrecker 21	Aug 1907	No information on original equipment
	1916	BLW4/GE216/K-37
Shifter Cars 26-28	1907	Peckham 7B/2 WP50/K-11 Subsequently 2 GE67
	1943	26 and 28 rebuilt: Westinghouse K-36-J controller
Wire Car 5	May 1908	?/?/?
	1911	TC/GE57/K-14

	1930	K-37
	1947	TC6/GE216
Snow Plow-Sweepers 29-32	Dec 1908	No information on original equipment.
		See NOTES
Work Car 33	Apr 1909	TC/GE67/K-6
	1922	TC/GE57/K-6
	1925	K-14; subsequently K-37
	1947	TC6/GE216
Rail Grinder 35	Nov 1909	Special/2 GE67/K-11
	1916	Bemis (sic) single truck
	1922	Special single truck
Snow Plows 36-38	Mar 1910	No information on original equipment.
		See NOTES
Sand Cars 43-45	Nov 1911	TC7/GE216/K-37
	1920	43 listed with one K-37-A and one K-28-A (for auger motor?
Work Car A13 Rebuilt	Apr 1912	Bemis/4 WP50/K-6
Work Car A14 Rebuilt	Apr 1912	Bemis/4 WP50/K-14
	1916	Brill01 from Cupola Car 61
Work Cars 46-48	May 1912	TC7/GE216/K-37-C (46 or 47 originally WP50/K-6)
	1935	46-48 exchanged GE216 for GE70 with cars rebuilt one-twoman
	1947	47 TC6/GE216 authorized; had TC7 until scrapped
	1949	46 motors from 1463; 48 motors from 1359; K-37
Refuse Car 49	Feb 1913	TC7/GE216/K-37
	1916	data sheet TC7/GE67/K-6
	1935	exchanged GE216 for GE70 with cars rebuilt one-two man
	1949	motors from 1354; K-37
Crane Car 50	Apr 1913	TC7/GE70/K-37-C
	1916	TC7/GE216/K-37-C
	1947	TC6/GE216 authorized
	Rebuilding Aug47/Mar48	TC7/GE216/K-35
Work Cars 51-56	Mar 1914	TC7/GE216/K-37-C
	1935	exchanged GE216 for GE70 with cars rebuilt one-two man
	1949	51 motors from 1444; 52 motors from 1453; 53 motors from 1399; 54 motors from 1380; 55 motors from 1443; 56 motors from 1378; K-37 Apparently 51 and 54 were not changed.
Cupola Car 58	Apr 1914	TC7/GE67/K-28-B
	1925	TC7/GE70/K-37
	1949	Motors from 1438
UofM Switch Car	Nov 1914	TC4/GE57/K-37 (TC4 was modified BLW3)
Sprinkler Car 59	Jan 1915	BLW4/GE57/K-37-C
Cupola Car 61	Apr 1915	Brill01/GE67/K-28-B
	1916	TCWC; Brill 01 went on A14
	1922	TCWC/GE67/K-28-B
	1925	TCWC/GE70/K-37
	1949	Trucks and motors from 1421 (still TCWC at 5-21-50)

Work Cars 62-69 May-Jul 1915 Brill01/WP50/K-6
1916 62-63 BLW1/GE70/K-6 (1916 data sheet)
1922 62 BLW1/WP50/K-6 63-69 Brill01/WP50/K-6
All subsequently received GE70
1947 63 TC6/GE216
1949 62 trucks/motors from 1356; 64 trucks/motors from 1333; 65 trucks/motors from 1474; 66 trucks/motors from 1336; 67 trucks/motors from 1371; 68 trucks/motors from 1455; 69 trucks/motors from 1435; K-37. (TC6 trucks seen on 66)

Sand Blast Car 70 Jul 1915 Bemis single truck/no motors or controller

Wire Car 72 May 1917 TC/GE57/K-14
1927 K-37
1947 TC6/GE216

Snow Plows 75-82 Dec 1917-Mar 1918 See NOTES

Private Car 1916 Brill 01/GE57/C-6
1922 Instruction Car Brill 01/no motors or controller

Crane Car 83 1927 National Coil Spring/GE275/C-169 Type M

Supply Car 95 rebuilt Oct 1936 from 1134 BLW1/GE70/K-28

Supply Car 97 rebuilt Aug 1947 from 1349 TC6/GE216/K-37-A(LB2)

NOTES

Snow Plows

Snow Plows each winter received the trucks, motors and controllers of the high-speed suburban cars but with a 17:73 gear ratio. The ten snow plows built by 1910 (22-24,29-32,36-38) usually received the equipment from Lake Minnetonka Division 1150 and 1160 series cars. The suburban cars then received BLW4/GE216/K-37 from the 1164-1195 series cars which in turn received trucks with GE70 motors.

According to the data sheets the eight later snow plows (75-82) received BLW2 trucks. However as of 5-5-1922 another record stated the 18 snow plows received BLW4/GE73/C-6-K equipment from suburban cars 1147,1149-1156,1158-1161,1163,1255-1256,and 1258-1259. These Suburban cars then received BLW4/GE216/K-43-F2 equipment.

During the summer months some of the Snow Plows apparently were stored on spare equipment. 1920 examples: number 32 Brill27/4 WP50/one K-11; numbers 75-77 TC7 trucks with the GE73 motors.

Transfer of Trucks and Motors from Scrapped Passenger Cars

Specific intention as of 1946 was as follows. 1331 to Wire Car 3, 1334 to Wire Car 4, 1361 to Work Car 8, 1363 to Work Car 11, 1365 to Work Car 15, 1372 to Work Car 17, 1414 to Wire Car 5, 1434 to Wire Car 72, 1445 to Work Car 63, 1447 to Work Car 13, 1456 to Crane Car 50, 1477 to Work Car 33, 1428 to spare equipment. The TC6 trucks from 1484 were to be scrapped with its GE216 motors to 1230 (1230's GE70 motors were to be scrapped). The company memorandum ordering the transfers was not issued until December 31, 1947. Cars 3-5,13,33,47,50,63 and 72 were to receive TC6/GE216 equipment; cars 8,11,15,17 were to receive TC5/GE213 equipment.

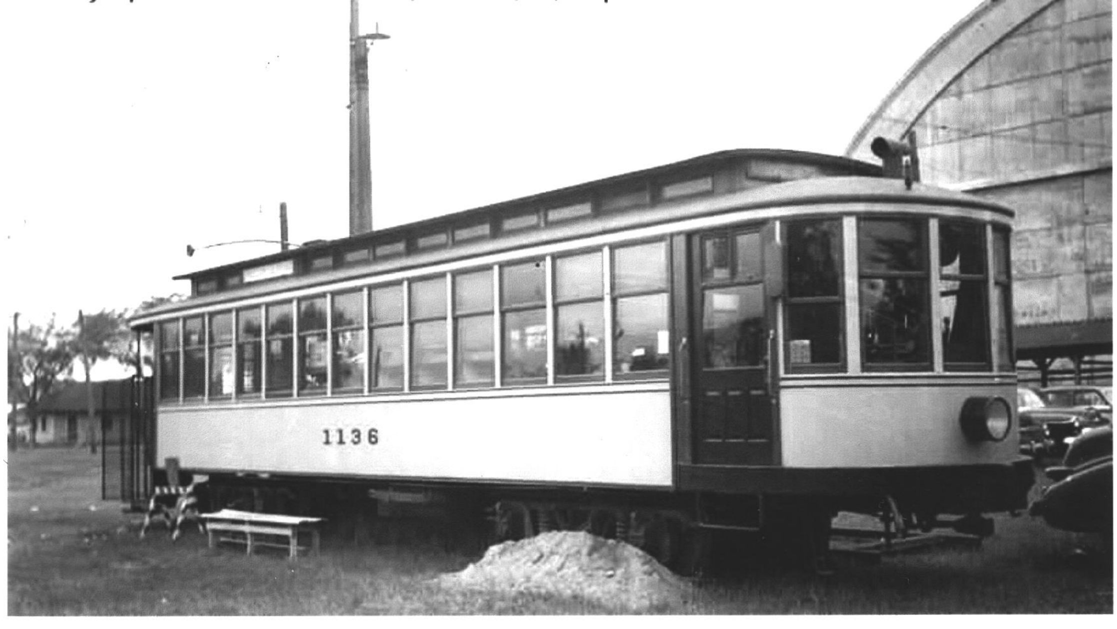
The Authorization for transferring trucks and motors from 25 scrapped front exit/gate cars was dated October 15, 1949. TC5 and TC6 trucks, GE213 and GE216 motors. All cars listed also were to receive K-37 controllers from the scrapped cars. The cars specified were: 7,9,10,14,16,18,19,46,48,49,51-56,58,61,62 and 64-69. Trucks and motors from 1458 were transferred to 1136 (Fair Grounds office car).

MAY 1948 MOTOR LIST

GE203	1166-1201,1203,1205-1211,1213-1218,1254,1266-1328,1329,1538,1567,1574, 1577,1591,1601,1603
GE213	1219-1229,1233,1235-1243,1246-1253,1335,1340,1343,1347-1350,1352,1364, 1367-1371,1374,1376-1378,1380-1399,1402-1405,1407-1409,1423,1452,1459, 1463,1469,1472,1478,1633,1634
GE216	1230 (from 1484),1244-1245,1332-1333,1336-1339,1341,1342,1344-1346,1351, 1354-1360,1362,1366,1373,1375,1379,1400-1401,1406,1410-1413,1415-1422, 1424-1427,1429-1433,1435-1444,1446,1448,1450-1451,1453-1455,1457-1458, 1460-1462,1464-1468,1470-1471,1473-1476,1479-1480,1482-1483,1485-1537, 1540,1542-1563,1565-1566,1568-1572,1575-1576,1578-1584,1586-1590, 1592-1600,1602,1604-1618,1620-1632,1635,1637-1644
GE 200	1539,1541,1564,1573,1585,1619,1636,1645-1854
GE 258	1-4,2000-2030

Scrapped 1947:

GE 213	1353,1361,1363,1365,1372
GE 216	1330,1331,1334,1414,1428,1434,1445,1447,1449,1456,1477,1481,1484



Twin City Rapid Transit 1136 at Fair Grounds, Saint Paul, MN, 1 Sep 1951

by Don Ross

G.E. 200 series Motors Used by TCRT

200 A, B, C, D, E, H, J, K, L, M
203 A, B, G, P, Q
213 A
216 C
258 A, C

July 19, 1917 Car Assignment when TCRT had 1,100 cars plus one train (peak).

Slow Cars (GE 57,67,70): 737-781,786-788,797-858,860-867,870-1107,1124-1107, 1124-1144,1164-1168,1189-1254,1266-1288	471 cars
Fast Cars (GE200,203,213,216): 1169-1188,1289-1855	587 cars
Suburban Cars (GE 73): 1112-1123,1145-1163,1255-1265	42 cars
Total	1,100 cars
Train: 2000-2000A	1 train

Station	Slow	Fast	Sub'n	Total	
East Side	41	123	21	185	
North Side	96	52		148	
Nicollet	99	82		181	plus one train
Lake St.	77	115		192	(one Slow double end: 899)
Snelling	71	167		238	(four Slow double end: 813,875-876,896)
E. 7th St.	82	48	21	151	(two Slow double end: 897-898)
Owen St.	5			5	
Totals	471	587	42	1100	plus one train

1952 East Side shopmen preferences:

Best to work on and keep in service:

1. GE 203G motors
2. GE 200 motors

K-43-F2 controllers

Stored first:

1. GE 213 and GE 216 motors
2. GE 203Q motors

K-37 controllers

Early "rule of thumb":

Twin City #5 trucks and GE 213 motors
Twin City #6 trucks and GE 216 motors
Twin City #8 trucks and GE 216/GE 203 motors
Twin City #9 trucks and GE 200 motors

MARCH 13, 1952

Motors in Service

G.E. 200-H	892	each
G.E. 203-G	301	each
G.E. 203-Q	295	each
G.E. 213-A	329	each
G.E. 216-A	1058	each
G.E. 258	159	each

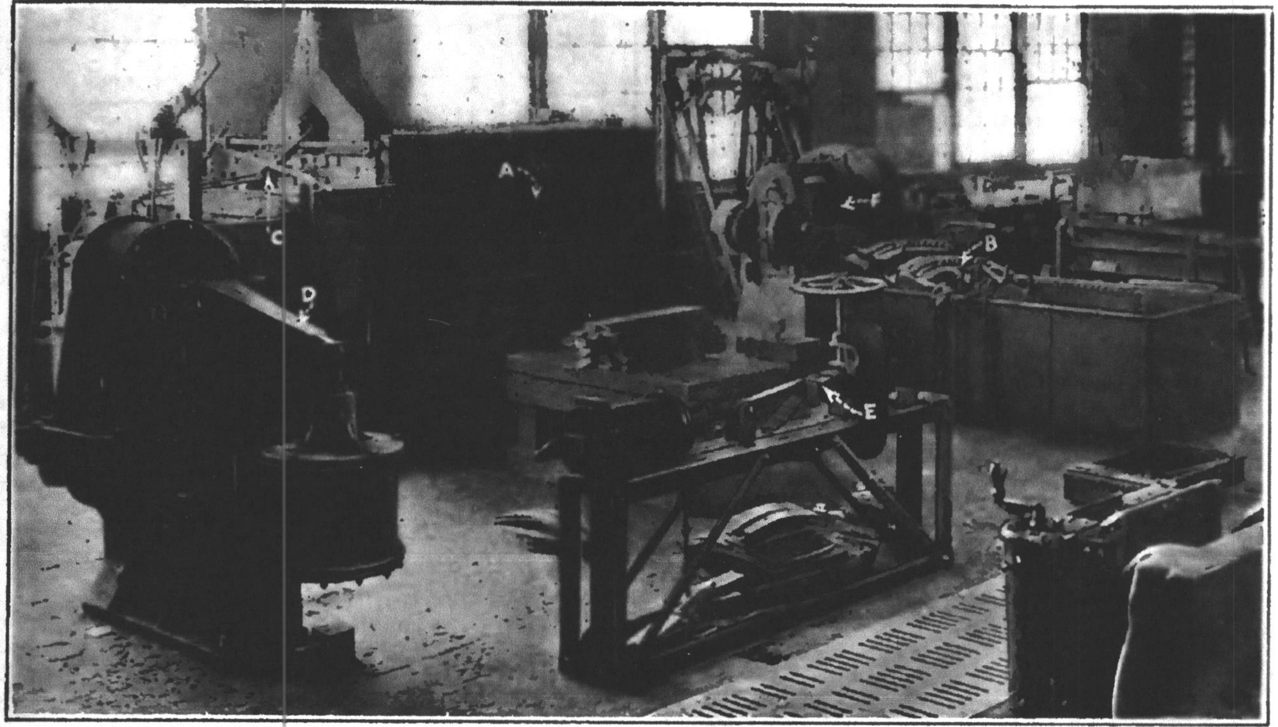
Air Compressor Models in Service

G.E. CP-21A
G.E. CP-21B
G.E. CP-25
G.E. CP-27A

Knutson #2 Trolley Retrievers

Maintaining Car Springs in Twin Cities

Proper Maintenance of Springs Is Considered to Be an Important Item in Improving the Riding Quality of Cars, Keeping Down Step Heights and Reducing Noise and General Wear and Tear on Equipment—Special Machine Equipment Results in Better Springs and Lower Cost



The Spring Department in the Twin City Shops Is Arranged to Reduce Handling

The leaves are first heated in the oil furnace, *A*, and after forming and quenching in the adjustable forming machine, *B*, they are tempered in the end of the furnace at *C*. Spring bands are made in the machine at *D* and are put on in the machine shown at *E*. In the background at *F* is the rolling machine for tapering the ends of the spring leaves.

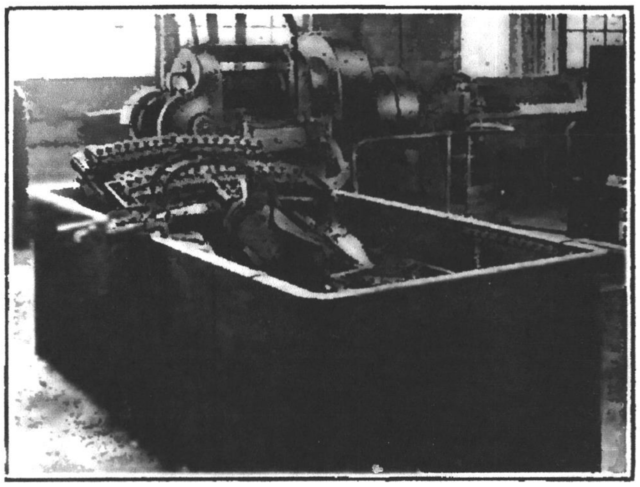
THE maintenance of car springs is considered of so much importance by the Twin City Rapid Transit Company, Minneapolis, Minn., that special equipment and machines have been developed in the company's Snelling Avenue shops for the work. In this way the costs have been held down to a point which makes it possible to replace springs on cars at the first indication of weakness. This renders it unnecessary to keep in service springs that have sagged, as is done sometimes by the expedient of inserting wooden blocks to maintain clearance between the car body and the apparatus underneath. Provision of proper facilities for the economical repair of defective springs eliminates the necessity of economizing in this particular way and thereby results in steps being maintained at the correct height, while the noise and general wear and tear on the equipment resulting from imperfect springs are reduced.

ONE MAN HANDLES EACH OPERATION

Much of the machine equipment used for spring work in the Twin City shop has been developed to meet the specific requirements of an operating company's maintenance shop, and the methods in use enable comparatively small lots of springs to be put through at reasonable cost. All of this equipment is located in one section of the forge shop and is arranged with a view toward efficient use of a minimum number of men. One of the features of this arrangement is that practically every step in the work is carried out as a one-man operation.

Spring steel is purchased in bars of the proper dimensions for making the leaves of elliptic springs. Physical and chemical specifications assure a high grade of material. The first step in the shop process is to shear this material to the correct length. The cut pieces are next taken to a power-driven rolling machine, shown in an accompanying illustration, where the ends are tapered. They are then trimmed to exact length.

After being trimmed the leaves are ready to be formed to the proper shape for the finished springs. They are heated to 1,550 deg. F. in an oil furnace, described later, and are formed and quenched automatically in a machine shown in an accompanying illustration. This combined forming and quenching machine, which was developed in the company's shop, is designed so that it can be adjusted to form any shape of spring used on the various cars in service. The die is made up of a series of slotted dogs, each of



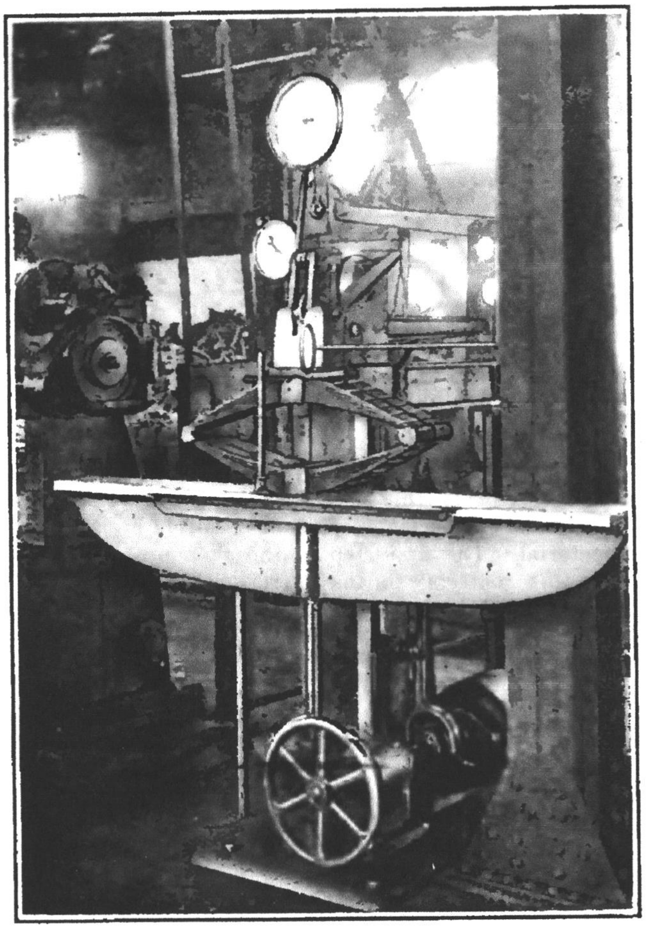
A Close-Up View of the Forming and Quenching Machine

This shows the adjustable dies for forming the leaves to proper shape. The tilting table carries a similiar die at the opposite end, which is immersed in the oil; as the operating piston moves first to one side and then the other, the two dies are alternately dipped in the oil. Two different spring leaves are run through alternately by a single workman.

which is held in place by bolts. To form a leaf of any given shape, it is only necessary to set the dogs against a standard template made for the purpose, which is shaped for that particular leaf. Then the various bolts are tightened and the die is ready for use.

A die of this type is mounted on each end of a tilting table, which is supported in the oil tank shown in the illustration. An air cylinder in the center has a piston at each end, so that manipulation of the air valve causes the movable part of the die to be pushed out, first on one end of the table and then on the other end. The whole apparatus is so balanced on a central pivot that the change in the distribution of weight, caused by change in the position of the piston and dies as one is pushed out and the other pulled back, causes the table to tilt first to one side and then to the other. Tilting of the table submerges the die with the hot spring leaf at one end and raises the one at the other end.

In practice, two different leaves are put through simultaneously, one man handling the entire operation, including the heating. The die at one end of the table is set to form one of the leaves of a spring and that at the other end is set to form another. The proper material for these two leaves is prepared and a number of each type are put in the oil furnace. The two dies are then used alternately to run through the two lots of spring leaves. The capacity of the machine is fixed only by the time required for the steel to cool in the oil. While this is taking place, after each leaf is immersed, the single operator has time to attend to the pieces of material heating in the furnace. As the piston is moved out, first toward one end and then toward the other end of the table, the leaf in the end that is raised out of the oil is released. It is readily removed from the die and set on a dripping screen to drain, preparatory to the next operation.



All Springs Are Tested to Uniform Specifications in This Standard Spring Testing Machine

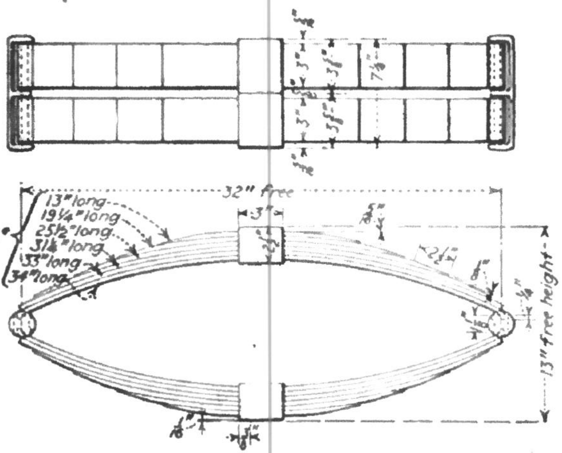
Leaves Heated and Tempered in One Furnace

After forming, the leaves are ready for tempering. This is done in another compartment of the same furnace in which they are originally heated for forming. The furnace is shown in an accompanying illustration. It is rectangular in shape and is so arranged that the doors at the front open into a compartment which is heated to about 1,550 deg. F. for the forming and hardening operation. These doors are convenient to the forming machine just described. The general arrangement is shown in the illustration. In the end of the same furnace another pair of doors open into a tempering compartment, to which the heat from the one burner is deflected, the temperature being adjusted by means of a regulating damper. In this way a saving in fuel is made, as the one burner serves two heating operations at widely different temperatures.

The tempering end of the furnace is divided into two sections, each fitted with individual doors. Thus the material in one compartment may be allowed to soak at the proper temperature while spring leaves are being withdrawn from the other. The tempering compartments are loaded in two layers, on gratings provided to increase the capacity. This furnace was furnished by the Mahr Manufacturing Company of Minneapolis and was specially designed to meet the requirements of this spring work. A suitable stack outlet for the tempering compartment draws off any gases that form and keeps them out of the shop.

When the formed spring leaves have been reheated to the proper temperature they are withdrawn by a workman who handles this end of the furnace and are individually fitted together while hot. They are then allowed to air cool.

Spring bands are forged in a commercial type of machine which is on the market for the purpose and



Complete Detailed Drawings for Each Type of Spring in Use Are Furnished to Shop Foremen for Their Guidance

WORKING LOADS

Deflection	Loaded Height	Load in Lb.	Car Load
2¼ in.	10¾ in.	4,000	Empty
3 in.	10 in.	5,000	Seated
4 in.	9 in.	7,200	Standing

which is shown in one of the accompanying illustrations. These bands are then placed on the springs, in a special machine designed and built in the shop. This is also shown in an illustration. It is designed so that the spring leaves are held together in a clamp mounted near one end of a light structural frame which forms the bed of the machine. At the other end is an air cylinder carrying a clevis that slides in a slot between two horizontal angle members. A pivoted shoe on the clevis is arranged to force the band into place over the spring leaves when air is admitted to the cylinder.

In practice, new material is added to elliptic springs only as required. Any of the old leaves that are not too badly corroded are retempered and used again. Thus the amount of new steel required is held to a minimum consistent with putting the springs in proper condition for service.

TESTING THE SPRINGS

All guesswork has been eliminated in this work by the installation of a modern spring testing machine. From the standpoint of securing satisfactory and uniform results, this testing work is considered second in importance only to the tempering of the material. It is considered to be impossible to determine just what results are being accomplished unless proper facilities for testing are available.

Shop foremen are furnished with detailed drawings showing the exact dimensions of each type of spring in use. In addition, specific test data showing the working loads and allowable deflections for the different springs on various cars have been worked up and are furnished in convenient data sheet form to those in charge of the repair and testing of springs.

All springs going through the shop are tested for deflection under working load. A loaded height of ⅛ in. more than that specified is permitted, but a variation below the specified height is not allowed. Free height is determined after the maximum working load has been once applied and fully released. After this the permanent set is determined by again applying maximum working load and then completely releasing the spring a second time. The difference between the height after this second load is released and the original free height indicates the permanent set. This is not allowed to exceed 1/16 in. If, however, there is any permanent set (not exceeding 1/16 in.) the spring is again fully loaded and released twice, and must thereupon show no increase in the amount of permanent set.

ERJ 6-21-1919

Hollow Boring of Axles to Reduce Weight

THE Twin City Rapid Transit Company, Minneapolis, Minn., has for the past seven years been hollow-boring all of its 4¼ x 8-in. car axles in order to reduce the total weight of the car. A special lathe machine was designed and built by the American Machine Company for this purpose. A hole 2 in. in diameter is bored through the center of the axle, reducing the weight of the axle approximately 60 lb. at a cost of 60 cents per axle. This figure is based on the cost of labor approximately three years ago, as no axles have been bored recently.

Since 1912 approximately 2500 axles have been hollow-bored with no detrimental effects. It is believed that the metal in the center of the axle contributes very little to the strength and this would seem to be borne out by the fact that of the 2500 axles on this property no breakages or other accidents have occurred. These axles are not heat-treated, but are bought in the rough by the company, and are forged and finished in the company's shops. It is claimed that hollow boring of heat-treated axles actually increases the strength of the axles.

TRUCK IDENTIFICATION

TRUCK IDENTIFICATION

EARLY SINGLE TRUCKS

BEMIS

Used almost exclusively on the single truck electric cars was the "Thomson-Houston Motor Truck with Bemis Gear" manufactured by the Bemis Car & Truck Co. beginning in 1890.

EARLY DOUBLE TRUCKS

BEMIS 29

The double trucks purchased from 1892 thru 1898 were all Bemis 29, first manufactured by the Bemis Car & Truck Co. in 1892. TCRT referred to them as Bemis M.T. (Maximum Traction)(Side Bearing) as they had off-center truck bolsters, designed for one motor per truck, although equal sized wheels were used on both axles. They were used on the double-truck closed cars purchased in 1892 and the double truck open cars purchased in 1892 and 1893. Also used the original double truck Snow Plows and Work Cars. TCRT reported they were satisfied with these trucks and purchased more of them during 1898 for the first TCRT-built passenger cars 737-758. The trucks from fourteen retired open cars were transferred to newly-built cars 759-772 in December 1898. Bemis 29 trucks were also used for newly-built cars 868-899 during 1901.

Beginning in May 1901 many of these trucks were rebuilt with centered truck bolsters and the designation was changed to Bemis C.B. (Center Bearing) for used with either one or two motors per truck. TCRT record cards use only the term "Bemis" for all of these trucks so one must rely on photographs to determine the type.

LATER DOUBLE TRUCKS

The basic clues to truck identification were provided by an early TCRT memorandum found in the master mechanic's files at the Snelling Shops. This covered trucks thru Twin City #9. I suspect it was prepared for use in the 1-1-1916 Mpls. St. Ry. Valuation. In this essay citations from the memorandum are enclosed by quotation marks.

BRILL [OLD]

"5'8" wheelbase, with no plate [gusset?] and outside hung brakes."

These were J. G. Brill Company 27-A1 trucks purchased during 1899 and were originally referred to as Brill trucks. The spring plank carriers have two bolts. At least 20 sets were acquired. They were used for sightseeing cars 737-738, the seven cars assigned to the St.Paul-Stillwater line, and some cars assigned to the Como-Interurban-Harriet line.The Private Car received Brill Old trucks and its Bemis 29 trucks went under 1899-built car 797.

During 1901-1902 these trucks were transferred to 607-626.

TWIN CITY

"Same as Brill trucks but with 5'0" wheelbase, extra rod across, outside hung motors and inside hung brakes."

TCRT records mention a shortage of iron and steel parts, trucks and motors during 1899 which delayed their carbuilding program. To keep the program going during 1900 TCRT was able to purchase some truck frames from the J. G. Brill Company which TCRT proceeded to modify and assemble in its shops. TCRT construction journals record costs of purchasing "arch beams" from Brill as well as costs of "fitting wheels and axles". 72 sets were reported constructed during 1900 but only 62 sets consistently appear on passenger cars. Originally used on 798-859 this was changed during 1901 to 762-788,797-831. These trucks were also used on Wire Cars 3-5,33,72 (5 cars).

BRILL 01, 02 and 03

"5'8" wheelbase, with no [gusset?] plate and outside hung brakes."

These were J.G. Brill Company 27-A2 trucks purchased in 1901, 1902 and 1903. The trucks purchased in 1901 were referred as "Brill New" and the 1899 trucks became "Brill Old". With subsequent purchases the designation was changed to include the last two digits of the year of purchase, except that "Brill Old" was never changed. The spring plank carriers on Brill 01 trucks have two bolts while those on Brill 02 and 03 trucks have four bolts.

Brill 01 were used originally on the Private Car, 752-761,832-867 (47 cars) and DSR 151-162 (12 cars). As of 1905 they were used on the Private Car and 832-867 (37 cars). They were also used on Work Cars 62-69 (8 cars) built May thru July 1915.

Brill 02 were used originally on 737-751,900-949 (65 cars). As of 1905 this had been changed to 737-761,868-899,900-904 (62 cars).

Brill 03 were used on 950-991 (42 cars).

BRILL 04

"6'0" wheelbase, heavy gusset plate and outside hung brakes."

These were J. G. Brill Company 27-E2 trucks purchased during 1904 for use on 992-1041 (50 cars). The spring plank carriers have four bolts. DSR 163-177 (15 cars) also built during 1904 are listed in DSR records as Brill 04 trucks but photographs indicate them to be Brill 27-A2 trucks. Brill Company literature indicates 27-E1 1/2 trucks had ample capacity for TCRT cars. So far the only actual reference to a model number appears in the 1-1-1916 Mpls. St. Ry. Valuation Report as "Twin City Brill 27-E2" but it applies to cars with Twin City trucks.

BALDWIN #1

"6'0" wheelbase and outside hung brakes."

These were Baldwin Locomotive Works Type 123 trucks. A BLW Truck Assembly drawing dated February 1904 rated the center pin capacity at 10,000 to 18,000 pounds. Originally used on cars 1042-1111,1124-1144 (91 cars) built from November 1904 thru November 1905. 905-949 were upgraded with these trucks during September-October 1905; the 32 sets of Brill 02 trucks from 908-939 were transferred to 868-899.

BALDWIN #2

"6'4" wheelbase and 2" frame."

These were Baldwin Locomotive Works Type 167 trucks. A BLW Truck Assembly drawing dated April 1905 rated the center pin capacity at 12,000 to 22,000 pounds. They were used on 1112-1123 (12 cars) built in August 1905 and on 1145 (1 car) built May 1906, all with G.E. 73 motors and high speed gears. Early photographs show a BLW builder's plate on the equalizer bars.

BALDWIN AND TWIN CITY BALDWIN-STYLE TRUCKS

The basic problem in Baldwin and Twin City truck identification is that in most photographs the camera angles, body shadows, and gate rods obscure the brake pull rods and often the equalizer bar noses. The truck assembly drawings indicate that gusset plate design is also necessary for proper identification but unfortunately can't be seen in car photographs.

BALDWIN #3

These were not listed in the TCRT memorandum. A Baldwin Locomotive Works Truck Assembly drawing dated May 1907 shows they were Type 338 trucks with G.E. 87 motors and center pin capacity rated at 24,000 pounds. They were used on 1146-1195 (50 cars) built May thru August 1906. Early photographs show a BLW builder's plate on the equalizer bars.

A comparison of the BLW drawing with TCRT Truck Assembly drawings of the Baldwin #4 and Baldwin #5 trucks show that the #3 truck was identical to the #4 truck except that the gusset plate was identical to that on the #5 truck. This infers that the #3 truck had what TCRT termed the "wide split [brake] pull rod around wheels".

When the G.E. 87 motors were replaced with G.E. 73C and 216 motors during 1909 the designation was changed from #3 to #4. After 1912 the #3 designation no longer appears. The University of Minnesota Switch Car was listed with Twin City #4 trucks and Sprinkler Car 59 with Baldwin #4 trucks, but both photos show the "wide split pull rod" so these must be Baldwin #3 originally. The Mpls. St. Ry. 1-1-1916 Valuation Report indicates Baldwin #4 trucks were scattered throughout the car fleet. It is curious that in only one instance, involving five cars of the 1380-1412,1414-1420,1423,1426 group with Baldwin #4 trucks, three cars (no numbers given) are specifically notated "split pull rods".

BALDWIN #4

"6'0" wheelbase and 2" frame."

These were Baldwin Locomotive Works Type 188 trucks. A BLW Truck Assembly drawing dated December 1905 indicates they had G.E. 73C motors with a center pin capacity rated at 15,000 to 24,000 pounds. Six sets of trucks and motors were purchased July 1907 for cars 1260-1265 built during August 1907 as high-speed suburban cars. Note the TCRT Truck Assembly drawing shows a different gusset plate design from the Baldwin #3. I have not been able to determine if the gusset plates and brake pull rods were changed on some Baldwin #3 trucks re-designated Baldwin #4. The mechanical dept. record cards listed these trucks on Service Cars 21,34,59, UofM Switch Car (4 cars).

BALDWIN #5

"6'0" wheelbase, same as Twin City #5 trucks."

Used on 1196-1259,1266-1309 (108 cars) built September 1906 thru August 1908 and on DSR 183-203 (21 cars) built September 1906 thru May 1908. It is the description for Twin City #5 trucks that first used the term "wide split pull rod around wheels" so both Baldwin #5 and Twin City #5 trucks had the "wide split pull rod". A complication is that the photo of a DSR car on page 397 has BLW builder's plates on the equalizer bars, and is listed in DSR records with Baldwin #5 trucks, but these trucks have the "outside brake pull rod" (see Twin City #6). Apparently DSR used the TCRT truck numbering system but limited its purchases to standardized designs, presumably to limit the variety of spare parts needed to be inventoried.

TWIN CITY #5

"6'0" wheelbase, wide split pull rod around wheels."

Used on 1310-1369 (60 cars) built November 1908 thru August 1909 and DSR 204-214 (11 cars) built June 1909. Refer to foregoing discussion under Baldwin #5 trucks. We have no TCRT Truck Assembly drawing. During and after the 1930's all #5 trucks are referred to as Twin City #5. Ed Nelson's notes state in 1954 he could not find any TCRT shopmen who were able to identify a #5 truck for him.

TWIN CITY #6

"6'0" wheelbase, short noze on equalizer bar, 1 1/2" frame, outside brake pull rod".

Used on 1370-1485 (116 cars) built July 1909 thru February 1911, and on DSR 215-219 (5 cars) built May thru June 1910, DSR 222-237 (16 cars) built May thru June 1911. The "short nose on the equalizer bar" appears on the TCRT Truck Assembly drawings for Baldwin #2, #4 and #5 trucks.

TWIN CITY #7

"5'8" wheelbase, 15" channel center with 5" channel around wheels."

These trucks were built only for Work Equipment. They were first built as "Twin City Work Car" trucks in April 1904 and used on Work Cars 7-19 and Locomotive 20 (14 cars) built from November 1904 thru August 1907. These trucks had outside hung brakes.

The designation Twin City #7 or Twin City #7 Work Car Trucks was applied to such trucks built from November 1911 thru April 1914. They were used on Work Cars 43-56,58 (15 cars). These trucks had inside hung brakes.

TWIN CITY #8
TWIN CITY #8RB

"6'0" wheelbase, long nose on equalizer bar, 1 1/4" frame, no holes in equalizer bar, outside brake pull rod."

Used on 1482-1685 (204 cars) built February 1912 thru February 1914 and on DSR 242-254 (13 cars) built May thru August 1912. The TCRT Truck Assembly drawing includes both Twin City #6 and #8 in the title although the drawing is of the #8 truck with the long equalizer bar nose. The only differences between the #6 and #8 trucks indicated in the TCRT memorandum are the frame thickness and the equalizer bar nose.

TCRT drawing 23D1551 titled "Truck Brake Arrangements No. 5-6-8 Trucks" implies that the brake shoe hangers and levers were the same on all three truck types.

Twin City #8RB trucks were #8 trucks equipped with roller bearing journals during 1936-1937 for use on cars being rebuilt for one/two man operation.

TWIN CITY #9
TWIN CITY #9RB

"5'6" wheelbase, holes in equalizer bar, outside brake pull rod."

Used on 1686-1855 (170 cars) built October 1914 thru June 1917 and DSR 257-278 (22 cars) built September 1914 thru June 1917. Fifty additional sets of #9 trucks were manufactured during 1918-1919. Six sets were shipped to DSR May 1919 for use on 289-294 (ex TCRT 1202,1204,1212,1231,1232,1234).

Twin City #9RB trucks were #9 trucks with roller bearing journals built new during 1928 for rebuilt cars 1254,1266-1328.

LIGHTWEIGHT CAR TRUCKS

These trucks were built after the date of the TCRT memorandum.

TWIN CITY #10

The first lightweight trucks: 4'8" wheelbase, inside arch bar frame, friction bearing journals, built April 1916 for cars 2000-2000A (later 2000-2001). Trailer 1590A (ex 952), renumbered 225, rebuilt July 1916 probably had these trucks.

TWIN CITY #11

An improved version of the #10 truck: 4'6" wheelbase, inside arch bar frame, roller bearing journals. Used without motors on Trailers 200-224 rebuilt July thru September 1921, and with motors on 2002-2003 built in November 1921.

TWIN CITY #12
TWIN CITY #12RB

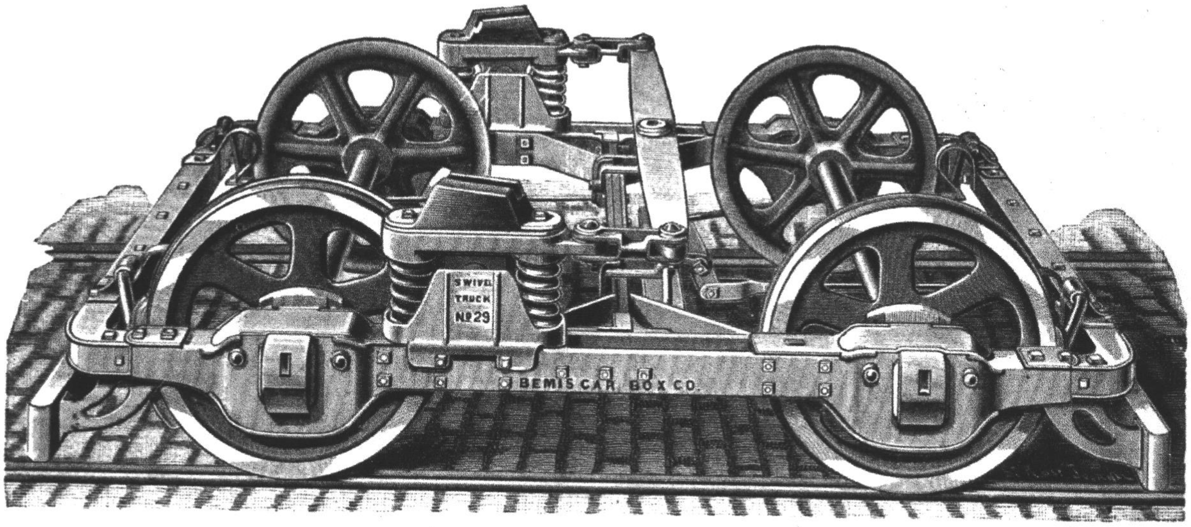
The final version of the lightweight truck: 4'6" wheelbase, inside arch bar frame, Hyatt roller bearing journals. Used on cars 1-4,2004-2030 built from March 1925 thru January 1928. There were variants of this design as drawings exist for a #12D truck dated May 1924 and a #12G truck dated February 1930.
The designation was later changed to #12RB. #12RB trucks were installed during 1928 on cars 2000-2003 replacing the older #10 and #11 trucks.

In 1938 eleven #12 truck frames built in 1925 for cars 1-4 plus three spare trucks were scrapped together with two #11 truck frames which were obsolete. Traction motors from cars 1-4 were re-installed in eleven #11 truck frames salvaged from Trailers 200-224.

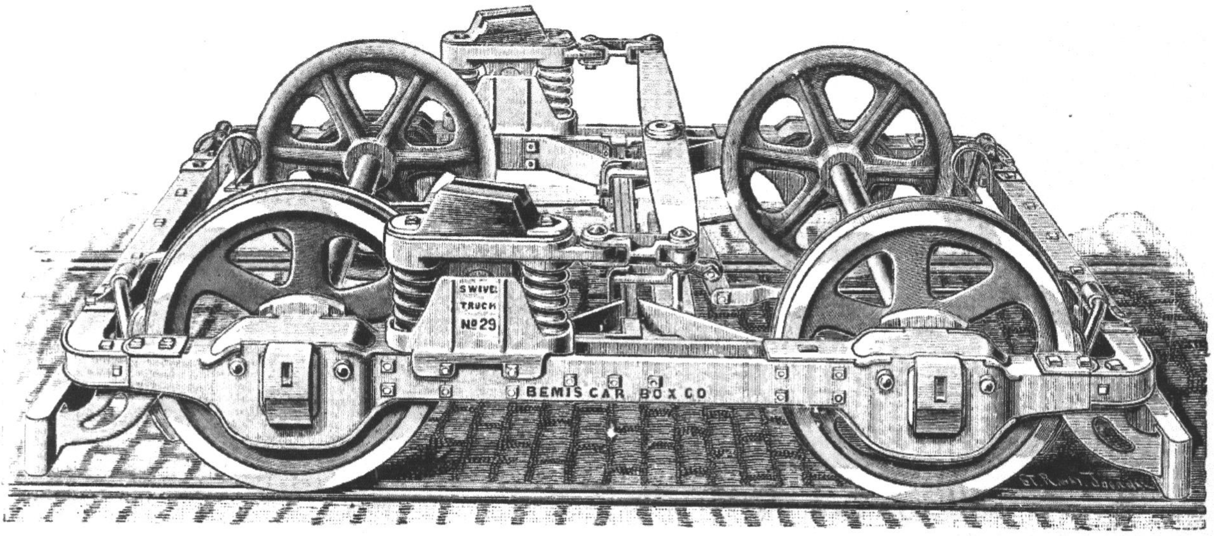
New Swivel Truck, No. 29.

The accompanying engraving illustrates a new swivel truck, No. 29, for eight wheel cars, designed and built by the Bemis Car Box Co. of Springfield, Mass. The truck has a short wheel base and swivels from its centre, but carries a large per cent. of the weight of the car on the motor axles, and while giving increased traction on the motor wheels, has standard sized wheels on both axles. This gives light draught and good braking qualities without increasing the height of the car above the track. Another important feature is the fact that there is no part of the truck over the motor, permitting of easy access to the latter for inspection, dismounting or making repairs.

The well-known Bemis box, which has given such excellent results in the past is, of course, used, and the material and workmanship of the truck are of the best.



NEW BEMIS STREET RAILWAY TRUCK.



THE BEMIS NO. 29 TRACTION MOTOR TRUCK.

(No Model.) 3 Sheets—Sheet 1.

G. M. HOADLEY & S. A. BEMIS.

RAILWAY CAR.

No. 477,935. Patented June 28, 1892.

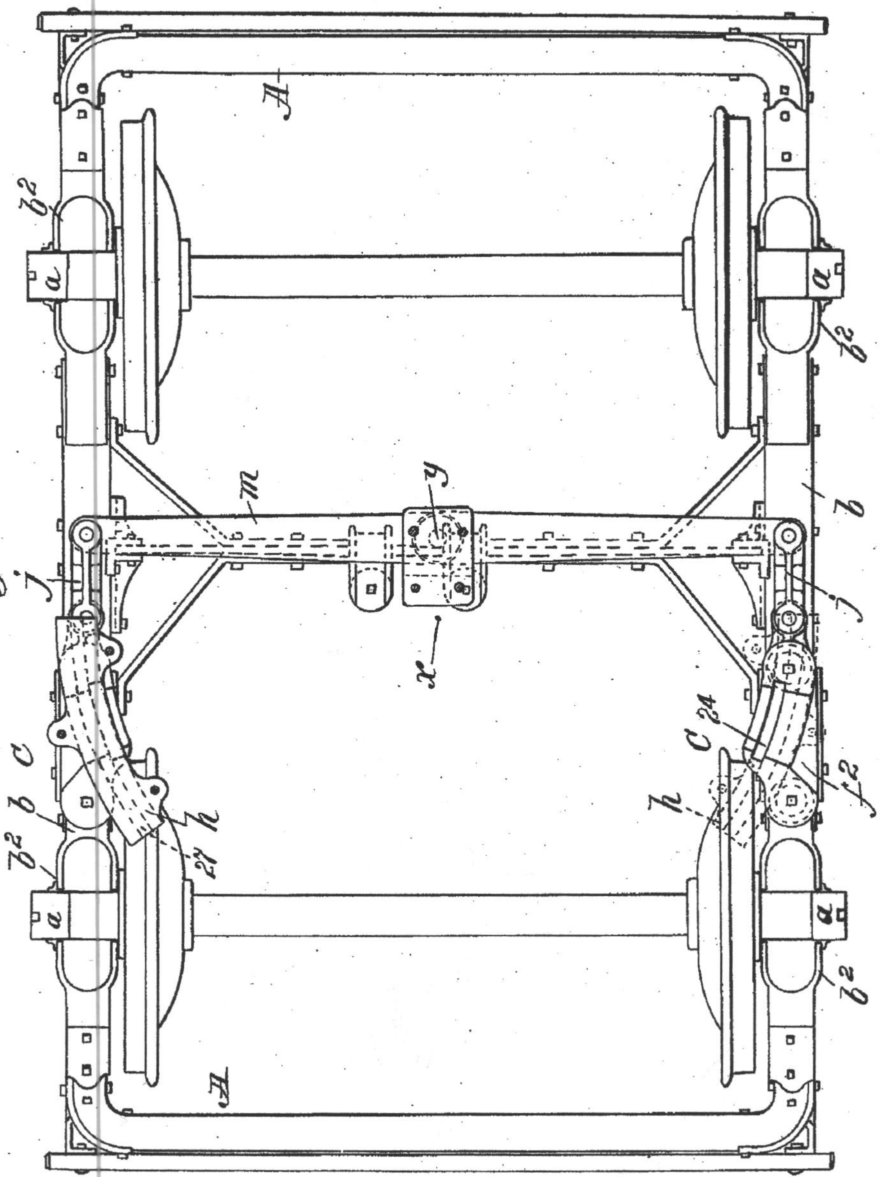

A
b^2
a
a
b^2
m
y
b
j
j
x
C
24
f^2
c
b
b^2
h
27
h
a
a
b^2
A

Fig. I.

Witnesses:
J. R. Garfield
T. F. Deneen.

Inventors
Geo. M. Hoadley
Sumner A. Bemis,
per Chapin & Co. Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

G. M. HOADLEY & S. A. BEMIS.

RAILWAY CAR.

No. 477,935. Patented June 28, 1892.

Fig. 2.

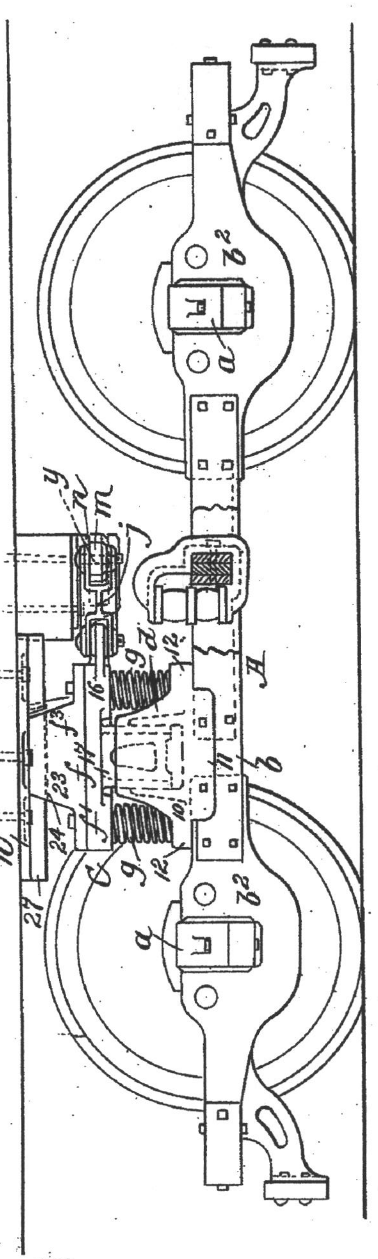

h
27
24
23
f
f1
17
f3
C
g
12
10
11
b
b2
a
A
d
16
y
n
m
j

Fig. 4.

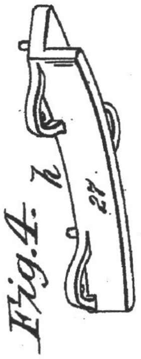


Fig. 6.

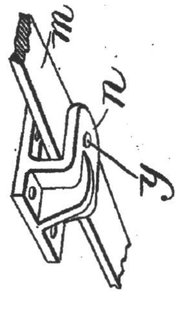


Fig. 5.

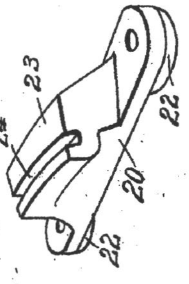
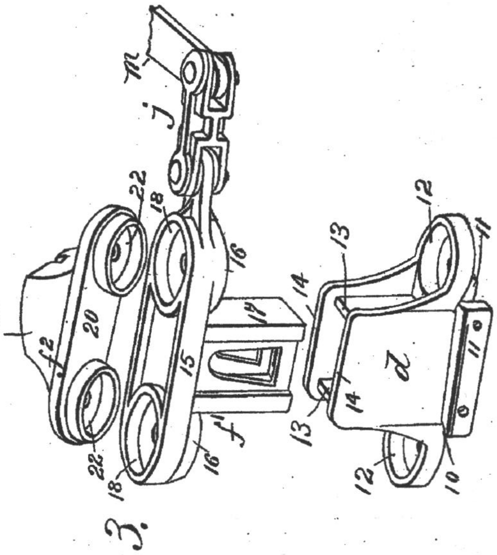

24
23
22
20
22

Fig. 3.


23
f2
20
22
22
18
18
15
16
16
j
m
f1
17
14
13
13
14
d
12
12
10
11
11

Witnesses
J. D. Garfield
T. F. Deneen.

Inventors.
Geo. M. Hoadley
Sumner A. Bemis,
per Chapin & Co.
Attys.

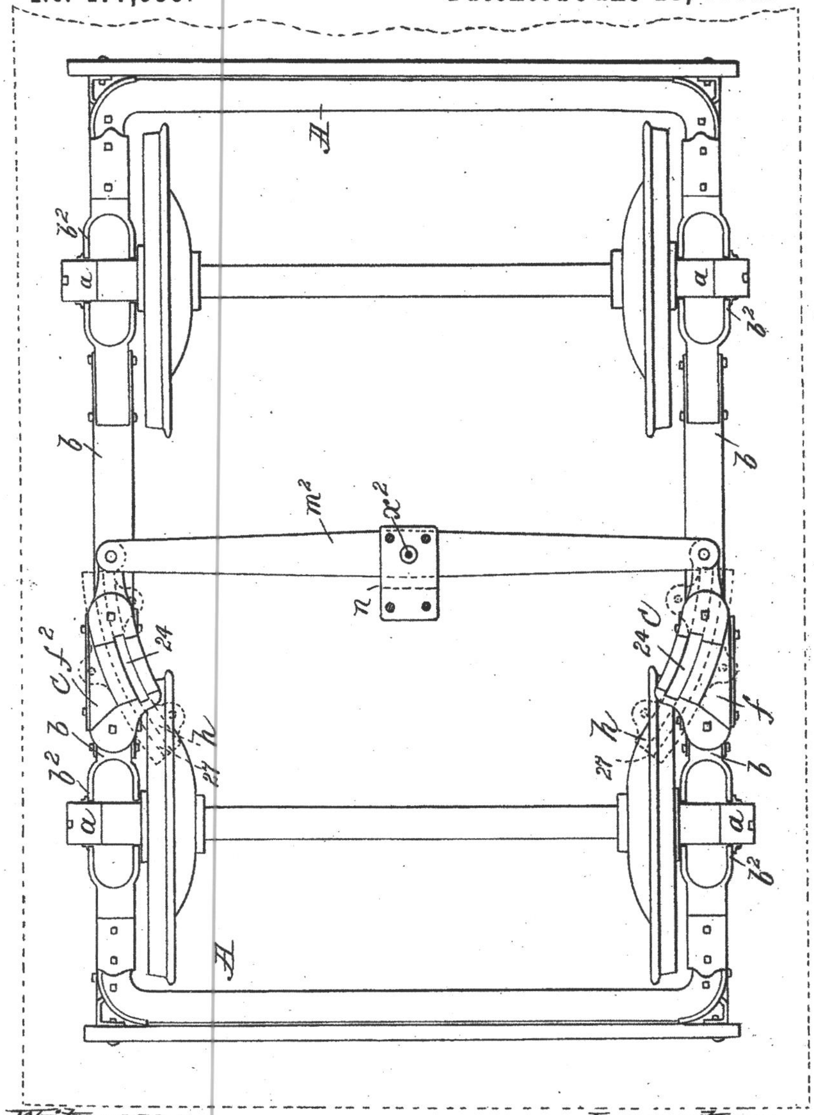
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

G. M. HOADLEY & S. A. BEMIS.

RAILWAY CAR.

No. 477,935. Patented June 28, 1892.

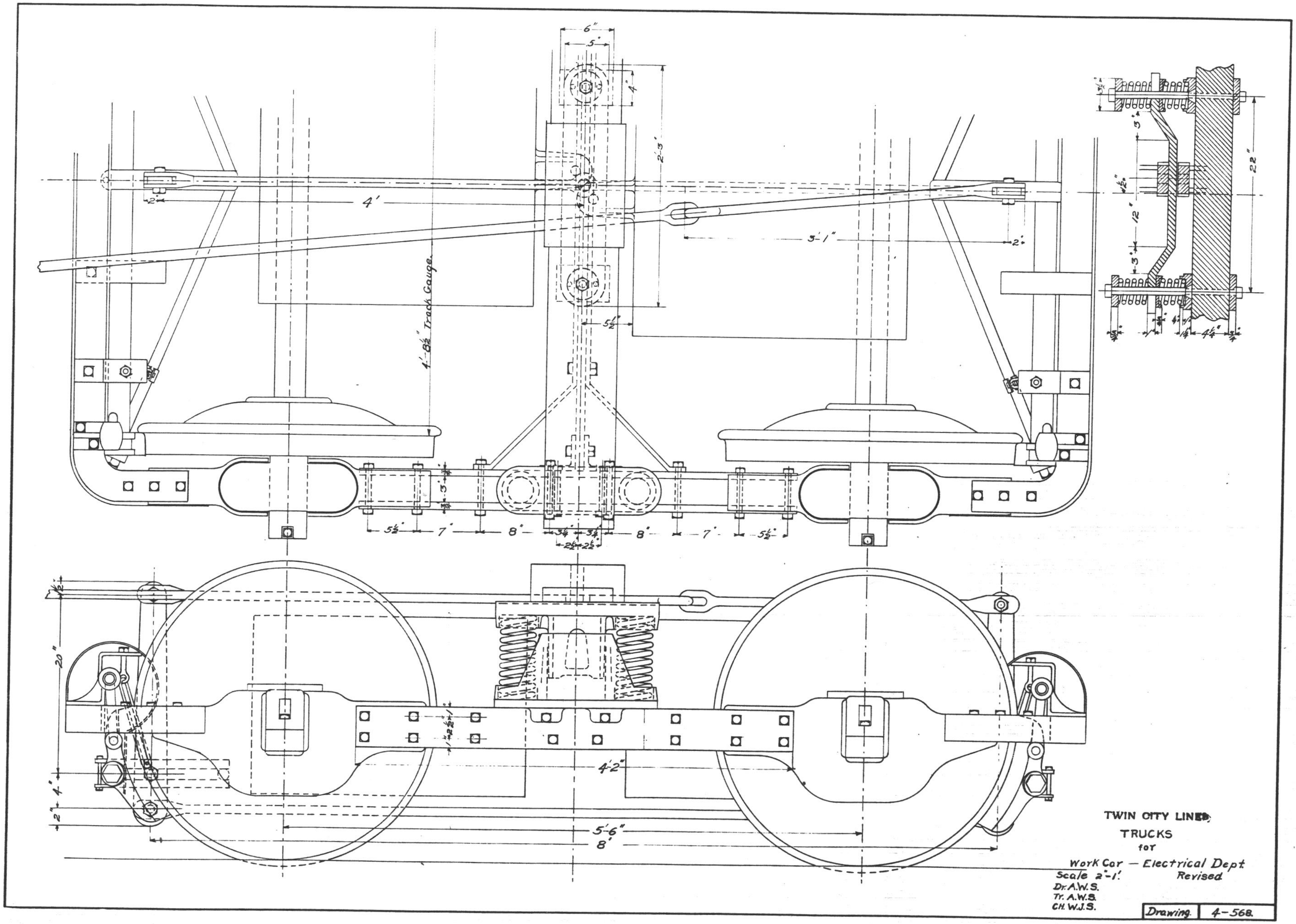

A
b²
a
a
b²
b
b
m²
x²
n
C
f²
24
24
C
b²
b
h
27
h
27
f
b
b²
a
a
b²
A

Witnesses:
J. M. Garfield
T. F. Denein.

Fig. 7.

Inventors.
Geo. M. Hoadley
Sumner A. Bemis
per Chapin & Co.
attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.


6"
5"
4"
2'-3"
4'
2"
3'-1"
2"
5½"
4'-8½" Track Gauge
3"
5½"
7"
8"
3¼
3¼
2½
2½
8"
7"
5½"
22"
12"
3"
3"
4½"
20"
4"
2"
4'2"
5'-6"
8'

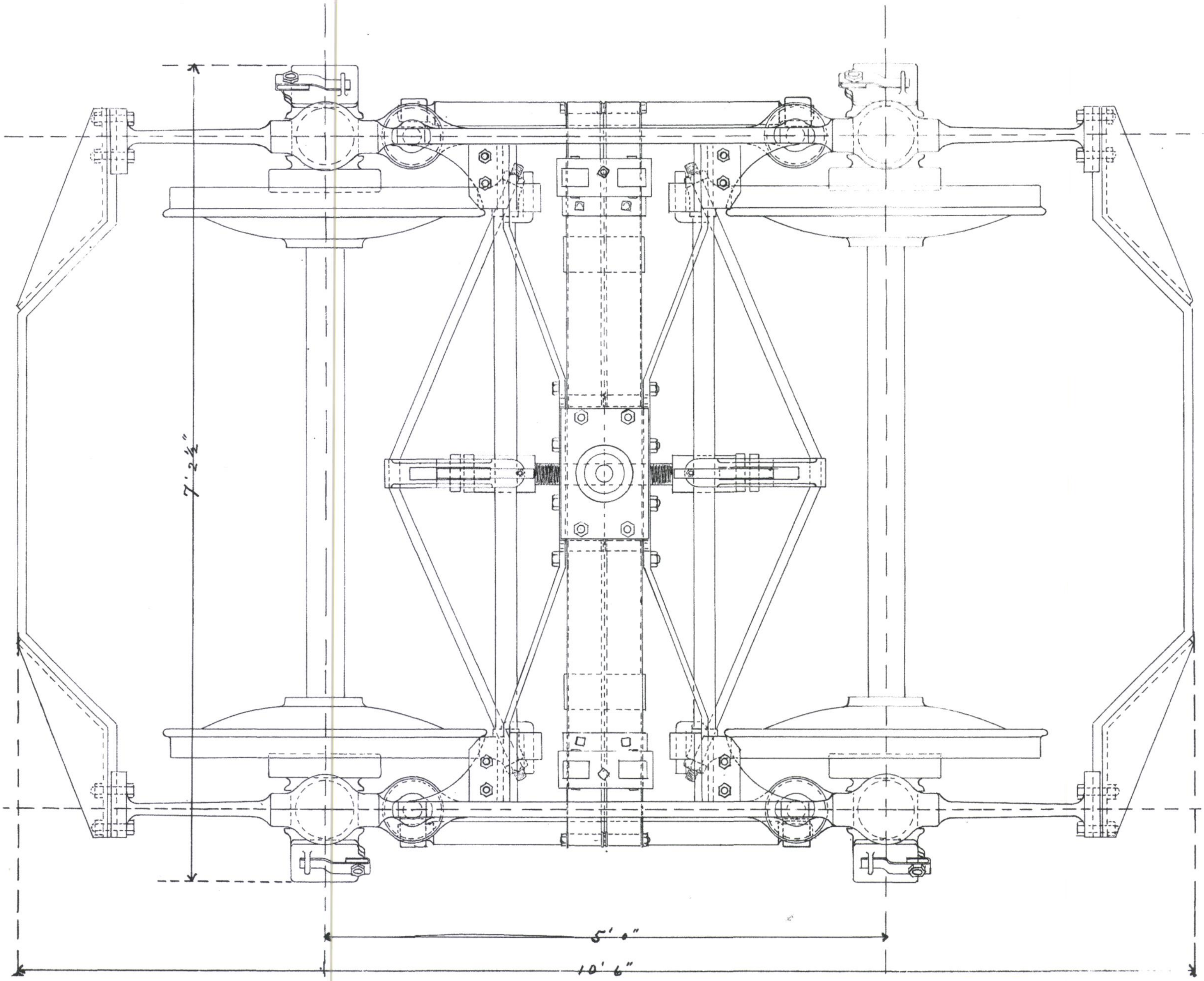
TWIN CITY LINES

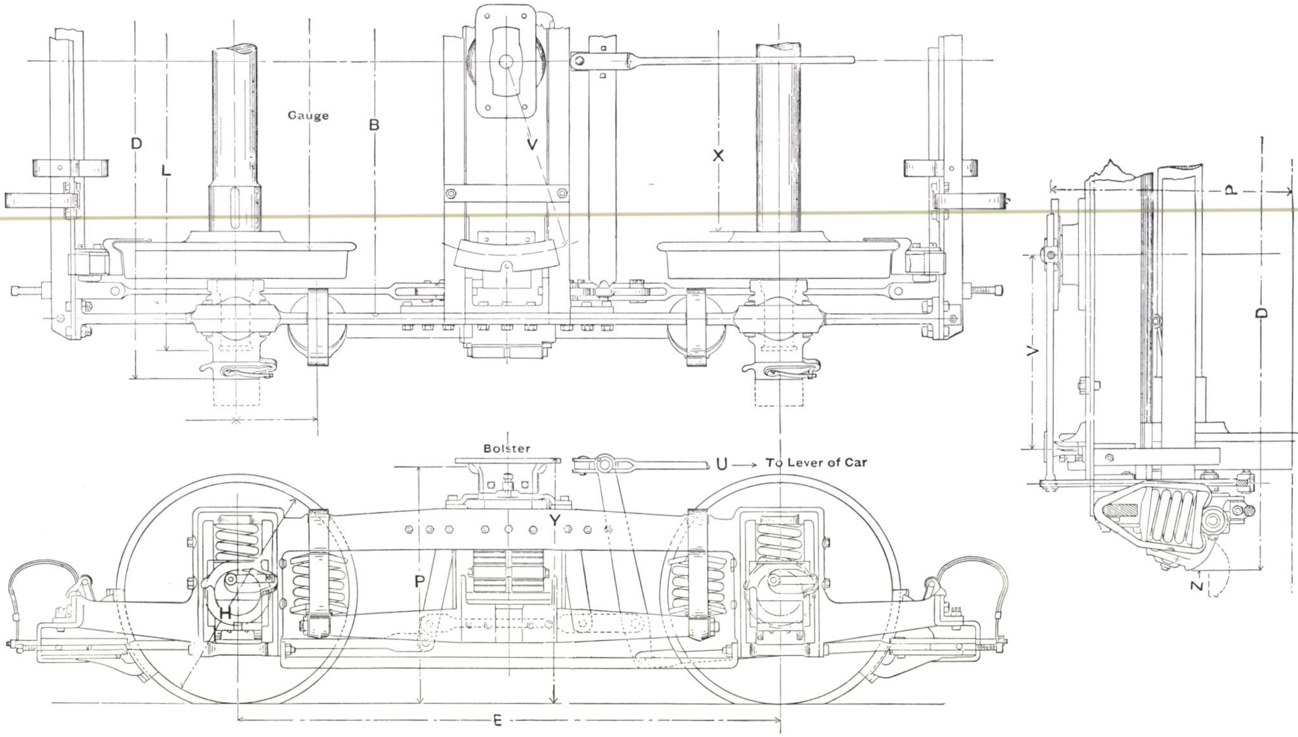
TRUCKS
for
Work Car — Electrical Dept
Scale 2"-1'.
Revised
Dr. A.W.S.
Tr. A.W.S.
CH. W.J.S.

Drawing. 4-568.

TWIN CITY TRUCKS

"Electric Railway Car Trucks" by E. Harper Charlton has extensive coverage of J. G. Brill Company truck design and manufacturing, including photographs. On page 39 he states "The list which follows is copied from the official Brill office listing of its trucks produced and is as complete as surviving records permit." I was unable to find anything in that list that describes these cast steel truck frames, apparently developed in the 1896-1898 time period. I have researched the digitized trade journals of that time period for more information, but without success. I did find one Brill truck part-number drawing that included "Arch Beams". My understanding that of that part is high-lighted in yellow on the Twin City Type Truck Assembly drawing.





No. 27-E-1 Truck

GAUGE	Centers of Frame B†	Radius of Rub Plates V	Width Over Jour. Boxes D†		Length of Axle L†
			Domestic	Foreign	
3′ 3⅜″	4′ 10⅝″	3′ 11″	6′ 1⅜″	5′ 8⅛″	5′ 6¼″
3′ 6″	5′ 2″	4′ 3″	6′ 4¾″	5′ 11½″	5′ 9⅝″
4′	5′ 8⅛″	4′ 8″	6′ 10⅞″	6′ 5⅝″	6′ 3¾″
4′ 8½″	5′ 9¼″	4′ 10″	7′	6′ 3¾″	6′ 4⅞″
5′	5′ 11⅝″	4′ 10″	7′ 2⅜″	6′ 9⅛″	6′ 7¼″
5′ 2½″	6′ 2⅝″	4′ 10″	7′ 5⅜″	7′ ⅛″	6′ 10¼″
5′ 3″	6′ 2⅝″	4′ 10″	7′ 5⅜″	7′ ⅛″	6′ 10¼″

E	Wheel Base	6′	6′ 6″	
H	Diameter of Wheels	30″	33″	36″
P	Height of Body Bolster with Empty Body	29½″	31″	32½″
Y	Height of Rub Plates with Empty Body	32½″	34″	35½″

No. 27-E-1½ Truck

GAUGE	Centers of Frame B†	Radius of Rub Plates V	Width Over Journal Boxes D†	Length of Axle L†
3′ 3⅜″	5′ 2″	3′ 11″	6′ 5¼″	6′ 1″
3′ 6″	5′ 4½″	4′ 3″	6′ 7¾″	6′ 3½″
4′	5′ 10½″	4′ 8″	7′ 1¾″	6′ 9½″
4′ 8½″	6′ 3″	4′ 10″	7′ 6″	7′ 1¾″
5′	6′ 6½″	4′ 10″	7′ 9½″	7′ 5¼″
5′ 2½″	6′ 9″	4′ 10″	8′	7′ 7¾″
5′ 3″	6′ 9″	4′ 10″	8′	7′ 7¾″

E	Wheel Base	6′	6′ 6″	
H	Diameter of Wheels	30″	33″	36″
P	Height of Body Bolster with Empty Body	29½″	31″	32½″
Y	Height of Rub Plates with Empty Body	32½″	34″	35½″

The Following Relates to All Sizes of This Truck

Z Contact Beam Support cast on Journal Boxes if desired.

U Truck Brakes furnished to this point only. King Bolt not furnished with trucks. Brake Rods are sometimes made to come between wheels.

X Distance between Hubs variable—to suit Motor.

† If width of Motor does not allow length of Wheel Hub to equal diameter of Wheel Bore, these dimensions may be increased.

No. 27-E-2 Truck

GAUGE	Centers of Frame B†	Radius of Rub Plates V	Width Over Journal Boxes D†	Length of Axles L†
3′ 3⅜″	5′ 6½″	3′ 11″	6′ 11½″	6′ 3¾″
3′ 6″	5′ 9″	4′ 3″	7′ 2″	6′ 6¼″
4′	6′	4′ 8″	7′ 5″	6′ 9¼″
4′ 8½″	6′ 3″	5′	7′ 8″	7′ ¼″
5′	6′ 6½″	5′	7′ 11½″	7′ 3¾″
5′ 2½″	6′ 9″	5′	8′ 2″	7′ 6¼″
5′ 3″	6′ 9″	5′	8′ 2″	7′ 6¼″

E	Wheel Base	6′	6′ 6″	7′
H	Diameter of Wheels	33″	36″	
P	Height of Body Bolster with Empty Body	35″	36½″	
Y	Height of Rub Plates with Empty Body	37″	38½″	

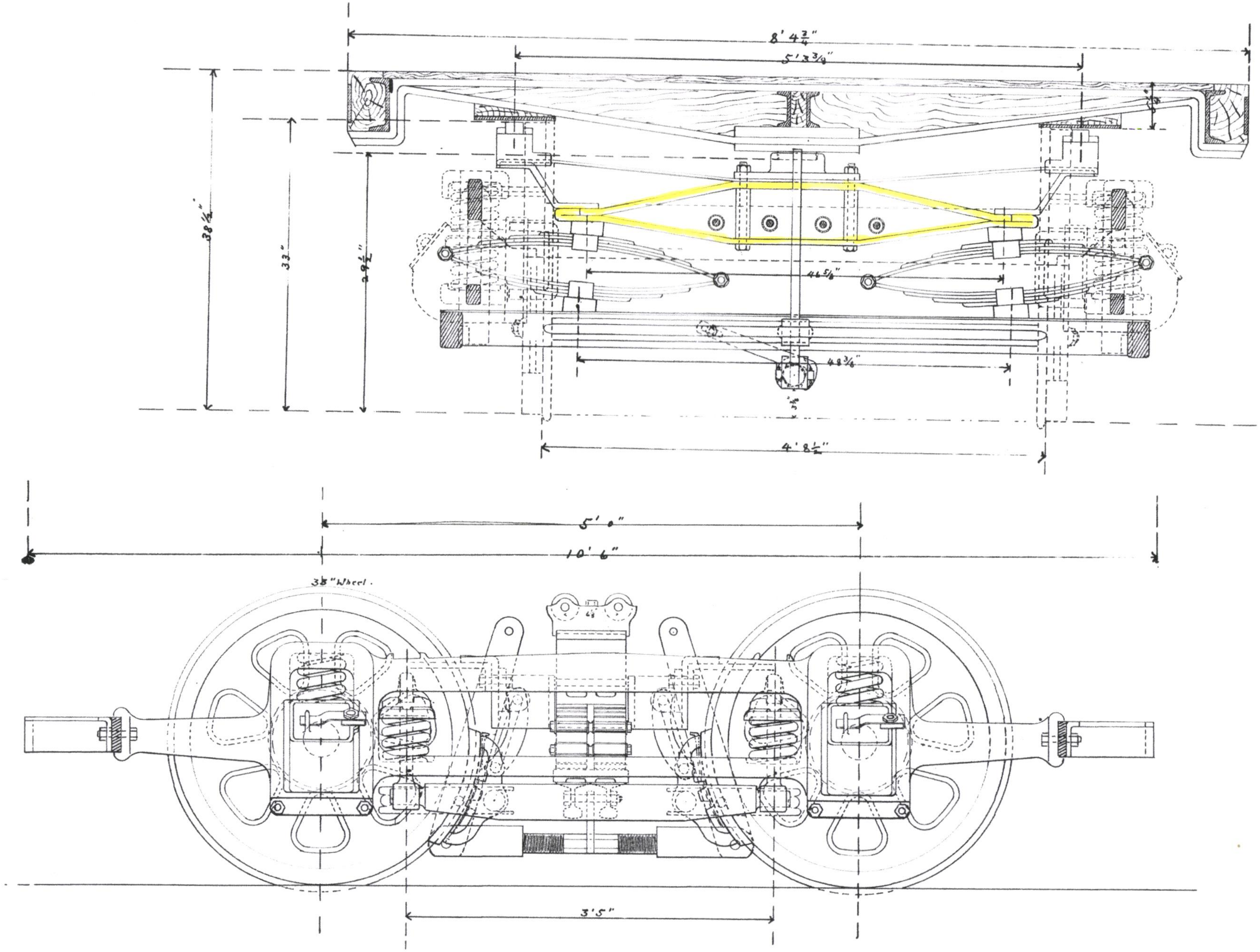
No. 27-E-3 Truck

GAUGE	Centers ot Frame B†	Radius of Rub Plates V	Width Over Journal Boxes D†	Length of Axle L†
3′ 3⅜″	5′ 7½″	3′ 11″	7′ ½″	6′ 6″
3′ 6″	5′ 10″	4′ 3″	7′ 3″	6′ 8½″
4′	6′ 4″	4′ 8″	7′ 9″	7′ 2½″
4′ 8½″	6′ 8″	5′	8′ 1″	7′ 6½″
5′	6′ 11½″	5′	8′ 4½″	7′ 10″
5′ 2½″	7′ 2″	5′	8′ 7″	8′ ½″
5′ 3″	7′ 2″	5′	8′ 7″	8′ ½″

E	Wheel Base	6′ 6″	7′	7′ 6′
H	Diameter of Wheels	33″	36″	
P	Height of Body Bolster with Empty Body	35″	36½″	
Y	Height of Rub Plates with Empty Body	37″	38½″	

The Following Limitations Are Recommended

	27-E-1	**27-E-1½**	**27-E-2**	**27-E-3**
Max. Size of Jour.	3¾″x7″	4″x7″	4¼″x8″	5″x9″
Weight of Carbody with Equipment and Passenger Load Not to Exceed	46,000 Lbs.	53,000 Lbs.	63,000 Lbs.	75,000 Lbs.
Speed Not to Exceed	50 M. per H.	60 M. per H.	65 M. per H.	75 M. per H.
Motors Not to Exceed	75 H. P.	100 H. P.	150 H. P.	200 H. P.


8' 4 3/4"
5' 8 3/8"
38 1/4"
33"
29 1/2"
46 5/8"
48 3/8"
4' 8 1/2"
5' 0"
10' 6"
33" Wheel.
3' 5"

TRUCK ASSEMBLY
TWIN CITY TYPE.
TWIN CITY LINES
MECH'L DEPT.

BACK AHEAD

5-9-01

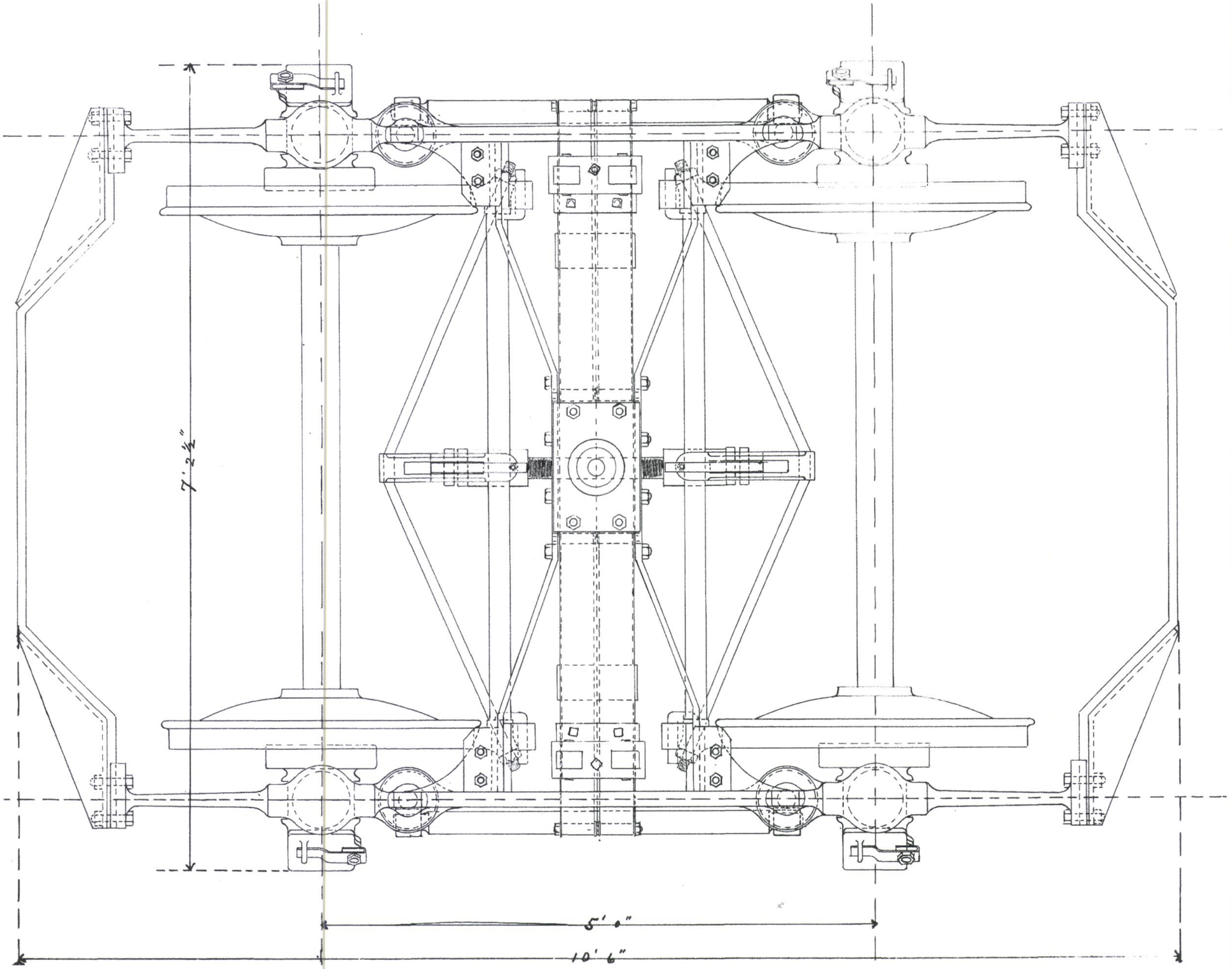
APPROVED

22D298

CORREC J. H. Smith
CHIEF DRAFTSMAN

TWIN CITY TRUCKS

"Electric Railway Car Trucks" by E. Harper Charlton has extensive coverage of J. G. Brill Company truck design and manufacturing, including photographs. On page 39 he states "The list which follows is copied from the official Brill office listing of its trucks produced and is as complete as surviving records permit." I was unable to find anything in that list that describes these cast steel truck frames, apparently developed in the 1896-1898 time period. I have researched the digitized trade journals of that time period for more information, but without success. I did find one Brill truck part-number drawing that included "Arch Beams". My understanding that of that part is high-lighted in yellow on the Twin City Type Truck Assembly drawing.



6-17-1904

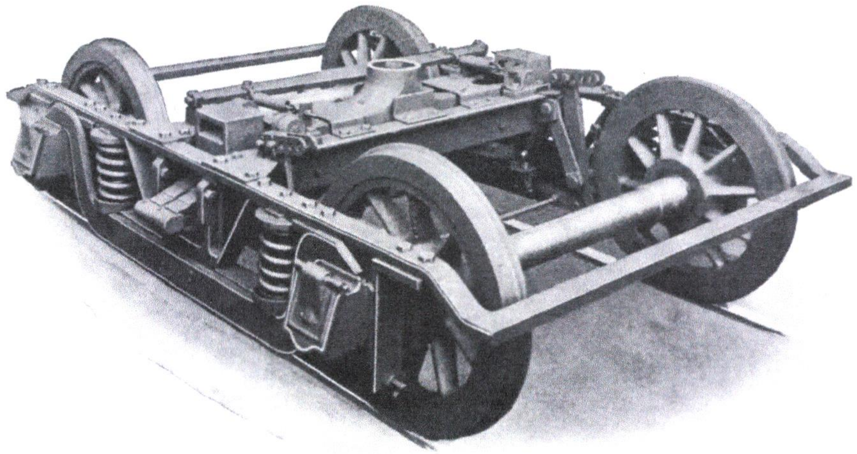
BALDWIN LOCOMOTIVE WORKS

Single Expansion and Compound

LOCOMOTIVES

Mine, Furnace, Logging and Industrial Locomotives, Operated by Steam, Compressed Air, or Electricity. Special attention given to the manufacture of

ELECTRIC CAR TRUCKS.

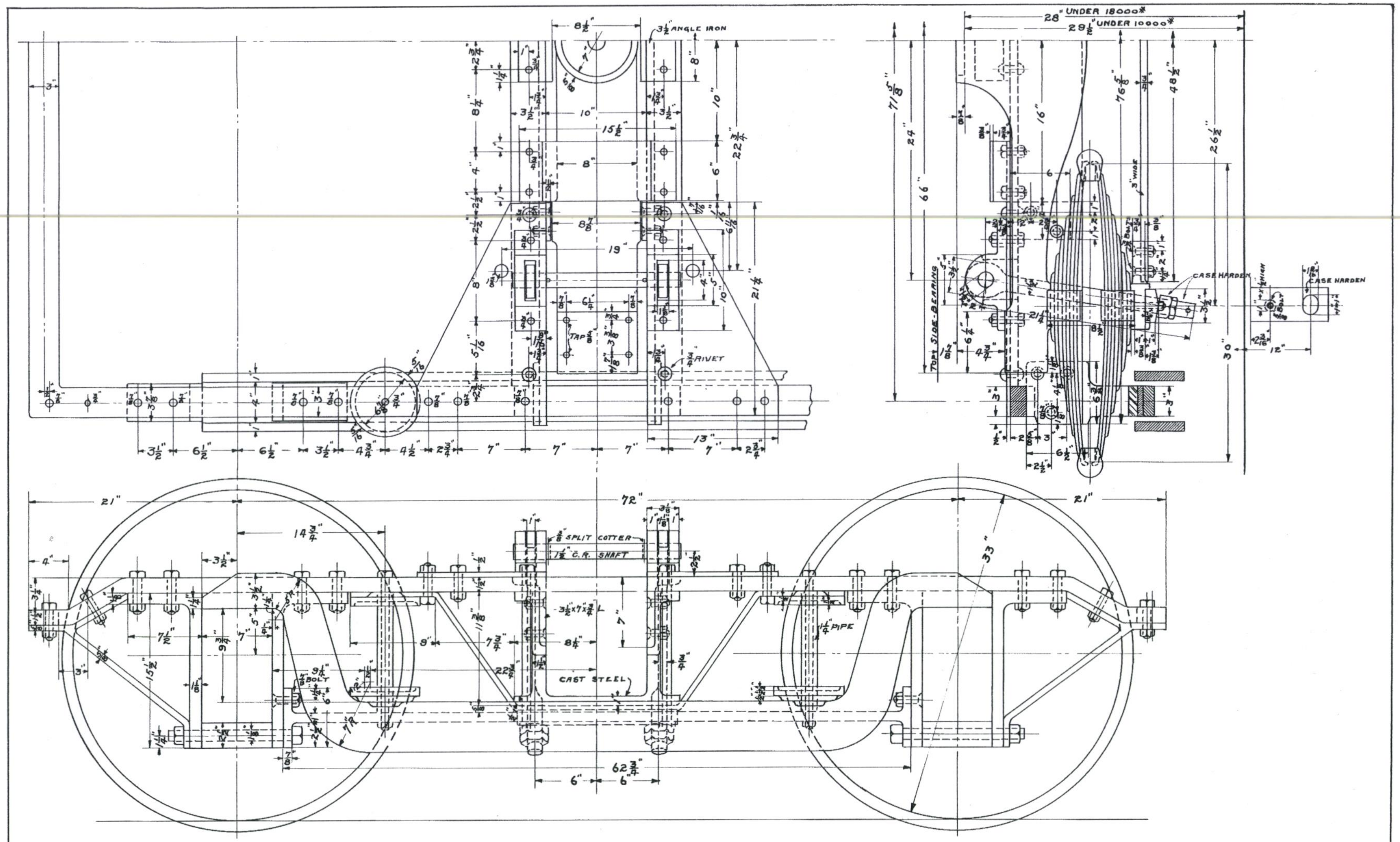


Built for the Twin City Rapid Transit Co., Minneapolis and St. Paul.

Double Trucks for Street Railway, Interurban and Long Distance Service. Built in accordance with the best locomotive practice.

The truck built for the Twin City Rapid Transit Co., and shown in Fig. 2, is a much lighter truck than Fig. 1, although of the same general design. It weighs 6,300 lbs., and is designed to carry only 18,000 lbs. on the center plate. Instead of the 10-in. channel transoms, 3½ in. x 7 in. angle iron has been used, and correspondingly lighter construction has been used throughout.

The photo in this advertisement is identical to, but larger than, Fig. 2 referred to in the text. 32 cars, 908-939, received Baldwin #1 trucks during 1904 replacing Brill 02 trucks transferred to 868-899. Some details in the photo differ from TCRT's Baldwin #1 Truck Assembly drawing. Newly built cars 1042-1111 and 1124-1144, completed November 1904 thru November 1905, received Baldwin #1 trucks. Photos indicate the Truck Assembly drawing is accurate for ALL cars that had Baldwin #1 trucks.


3½" ANGLE IRON
28" UNDER 18000#
29½" UNDER 10000#
3" WIDE
CASE HARDEN
CASE HARDEN
TOP SIDE BEARING
PIPE
RIVET
TAP
⅝" SPLIT COTTER
1½" C.R. SHAFT
3½"×7"×⅞" L
CAST STEEL
1¼" PIPE
BOLT
72"
21"
21"
33"
62¾"
14¾"
8½"
19"
22¾
21¼
71⅝
66
24
46⅝
48½
26½
30
12"

TRUCK ASSEMBLY

BALDWIN No 1.

TWIN CITY LINES

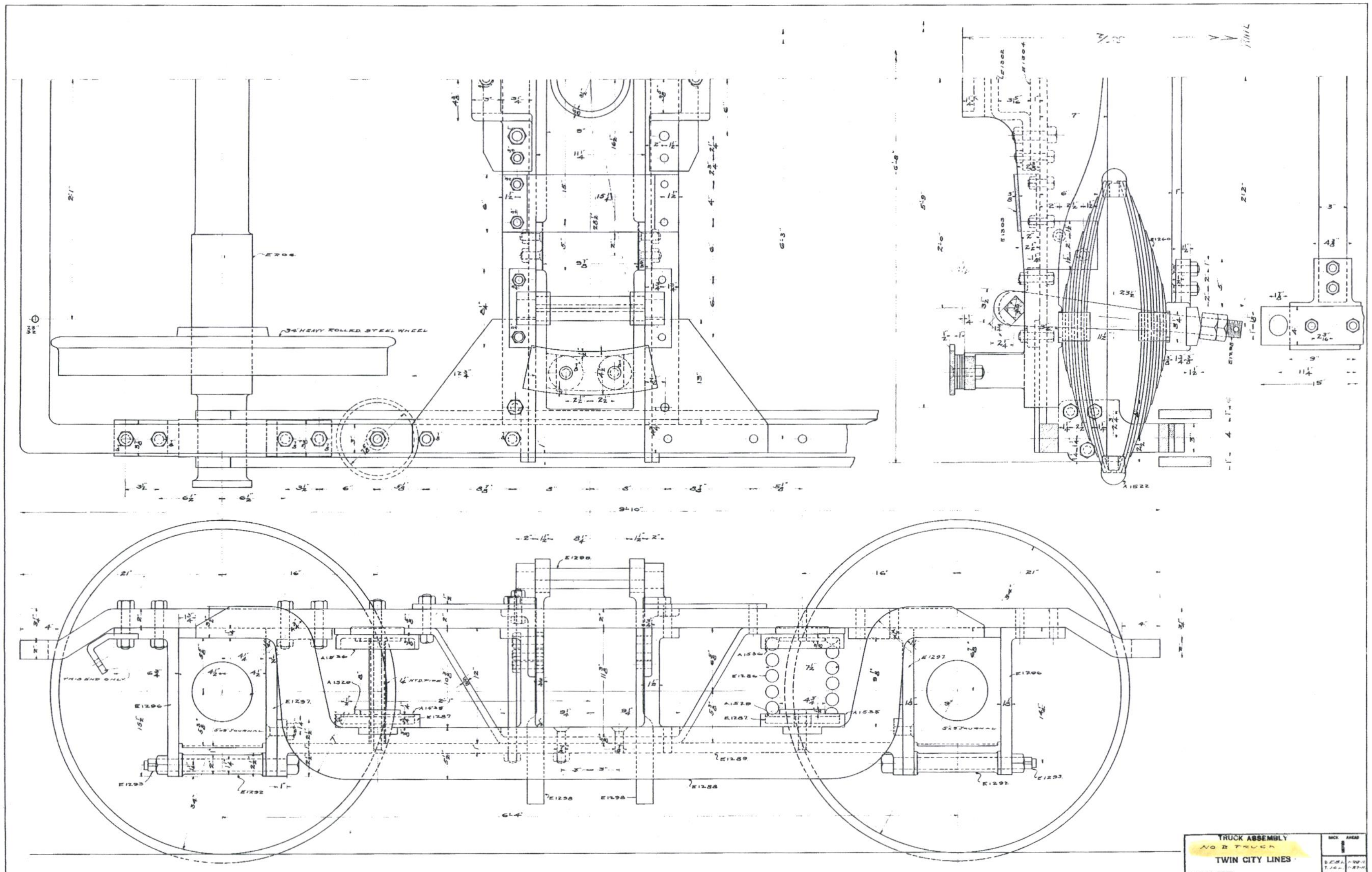
MECH'L DEPT.

		BACK	AHEAD
		REFER	
		D.C.S.C.	1-11-05
		T.J.C.V.	"
		C.J.C.V.	"

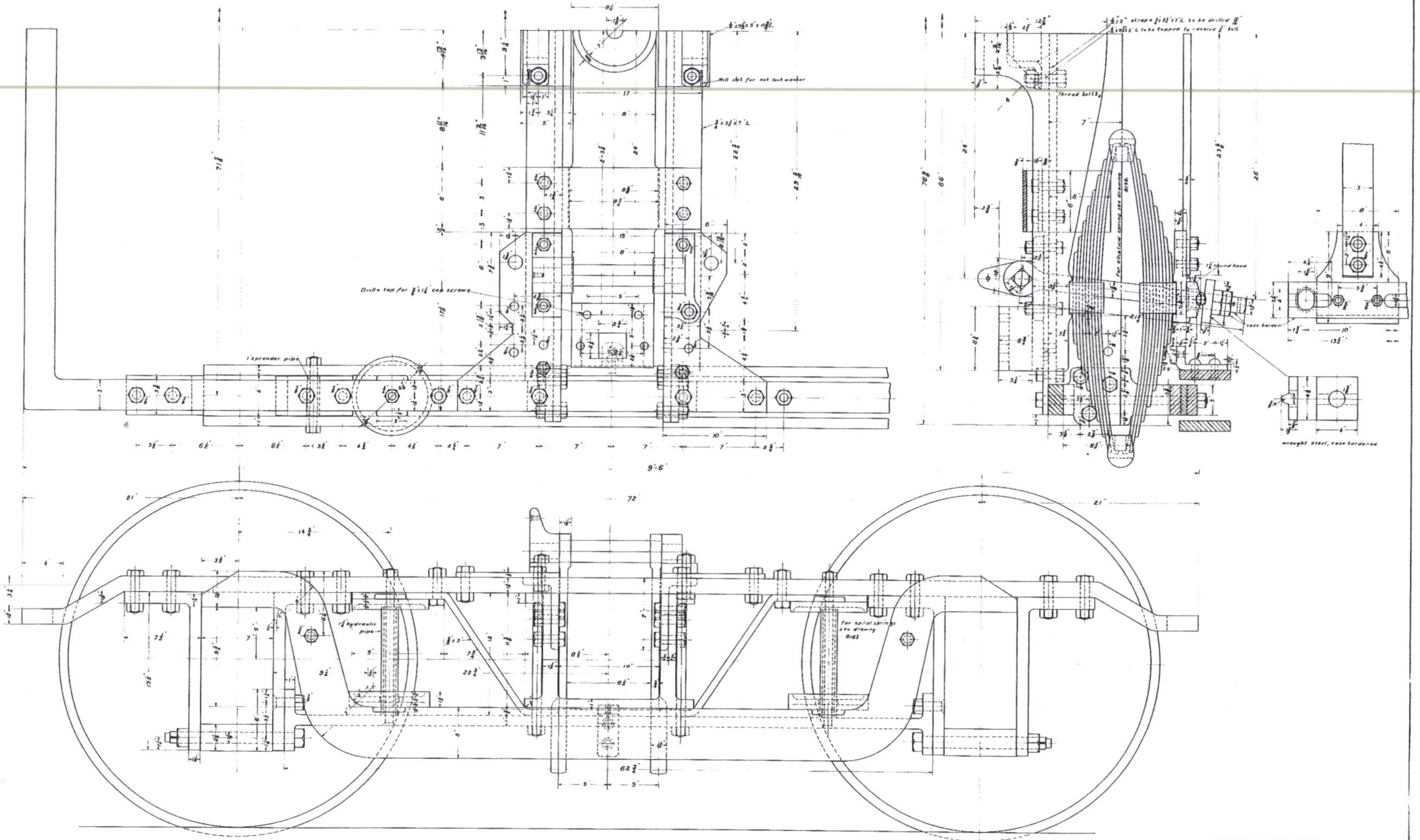
APPROVED — MASTER MECHANIC

27C800

J. H. Smith — CHIEF DRAFTSMAN


34" HEAVY ROLLED STEEL WHEEL
THIS END ONLY
5x9 JOURNAL
1¼" X-TRA PIPE
E1296
E1297
A1522

TRUCK ASSEMBLY
NO B TRUCK
TWIN CITY LINES
MECH'L DEPT.
BACK AHEAD
D. C.B.L. 1-26-11
T. J.G.L. 1-27-11
C. E.B.L. 1-30-11
APPROVED MASTER MECHANIC
27D1378
CORRECT J. H. Smith
CHIEF DRAFTSMAN


Drill & tap for ⅜ x 1¼ cap screws
Mill slot for nut lock washer
1 spreader pipe
Thread bolts
case harden
1¼ round head
wrought steel, case hardened
For elliptical spring see drawing 8158.
1¼ hydraulic pipe
For spiral springs see drawing 8163
9'-6"
72
21
62¾
10

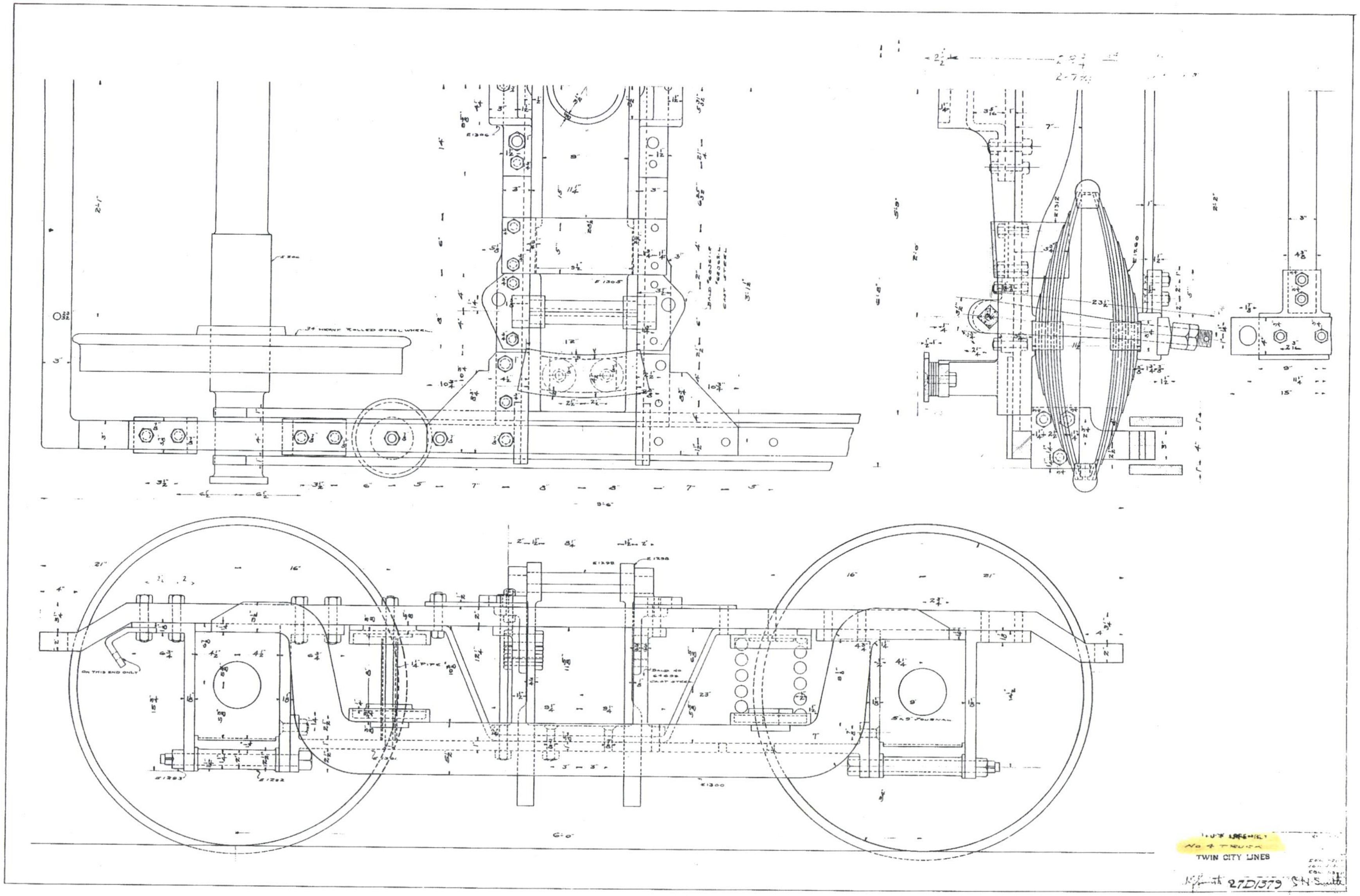
TRUCK ASSEMBLY
BALDWIN TYPE NO 5.
TWIN CITY LINES
MECH'L DEPT.

BACK	REVISED
D. R. D. S.	8-26-[illegible]
C. W. J. S.	"

APPROVED W. H. Smith
MASTER MECHANIC

2713801

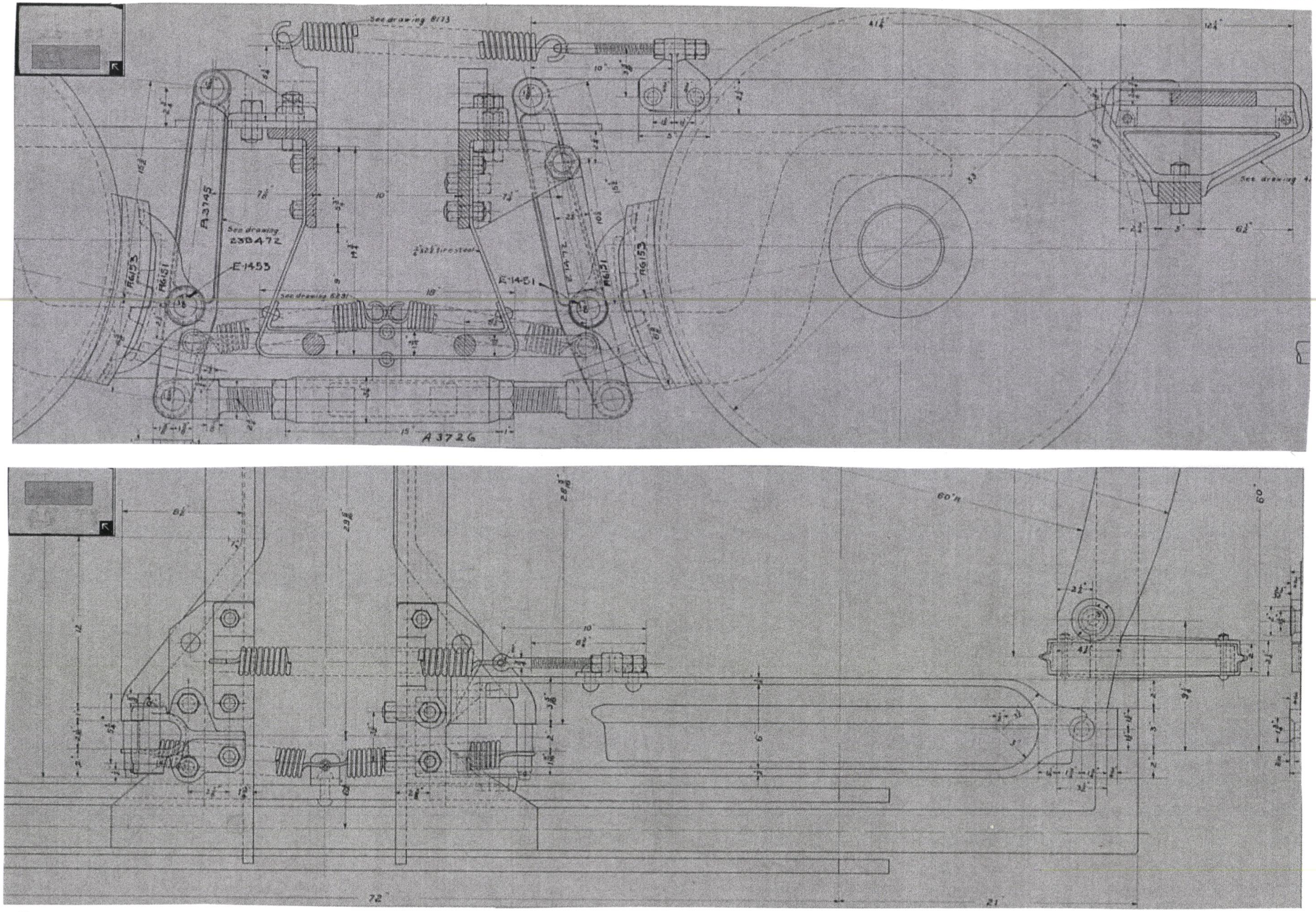
CORRECT J. H. Sunathe
CHIEF DRAFTSMAN


34 HEAVY ROLLED STEEL WHEEL
ON THIS END ONLY
1¼" PIPE
CAST STEEL
5x9" JOURNAL
23"
9'-6"
6'-0"
21"
16"

TRUCK ASSEMBLY
No 4 TRUCK
TWIN CITY LINES

27D1579 S.N. Smith

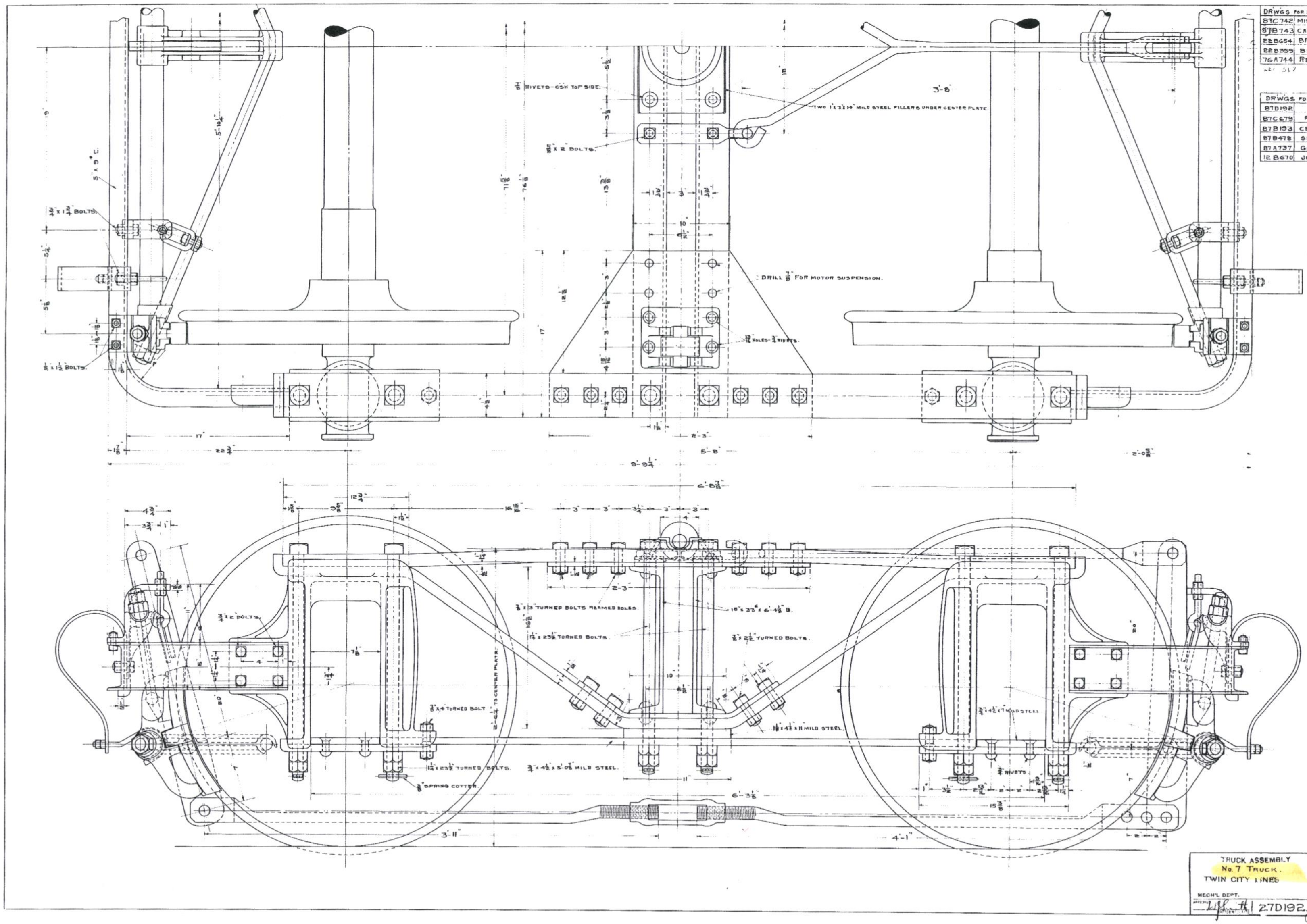
AVERY®c
PV119ED


See drawing 6113
A3745
See drawing 23B472
E1453
A6151
A6153
See drawing 6231
E1451
A3726
60"R
60"
72"
21"

"WIDE SPLIT PULLROD" BLW#3 AND BLW#5

TRUCK BRAKE ARRANGEMENTS

TC No. 5 24D839 MAY 1917


5/8" RIVETS–CSK TOP SIDE.
3/4" x 2" BOLTS.
TWO 1" x 3" x 14" MILD STEEL FILLERS UNDER CENTER PLATE
DRILL 7/8" FOR MOTOR SUSPENSION.
13/16" HOLES–3/4" RIVETS.
5" x 9" C.
3/4" x 1 3/4" BOLTS.
3/4" x 1 1/2" BOLTS.
3'-8"
19"
5'-10 1/4"
71 5/8"
76 1/8"
17"
22 3/4"
1 7/8"
9'-9 1/4"
5'-8"
2'-3"
2'-0 5/8"
6'-8 7/8"
12 3/4"
16 15/16"
4 3/4"
3/4" x 2" BOLTS.
7/8" x 3" TURNED BOLTS REAMED HOLES.
1 1/4" x 23 1/2" TURNED BOLTS.
15" x 33" x 6'-4 1/8" B.
7/8" x 2 1/2" TURNED BOLTS.
7/8" x 4 TURNED BOLT.
2'-6 3/4" TO CENTER PLATE.
1 1/4" x 23 1/2" TURNED BOLTS.
3/4" x 4 1/2" x 5'-0 5/8" MILD STEEL.
3/8" SPRING COTTER.
1 1/2" x 4 1/2" x 11 MILD STEEL.
3/4" x 4 1/2" x 7 MILD STEEL
3/4" RIVETS
15 3/8"
6'-3 1/8"
3'-11"
4'-1"
20"
10"
6 1/2"
11"

DRWGS FOR No. 7 TRUCK BRAKES.	
87C742	MILD STEEL DETAILS.
87B743	CASTING DETAILS.
22B654	BRAKE HEAD.
22B359	BRAKE SHOE.
76A744	RELEASE SPRING

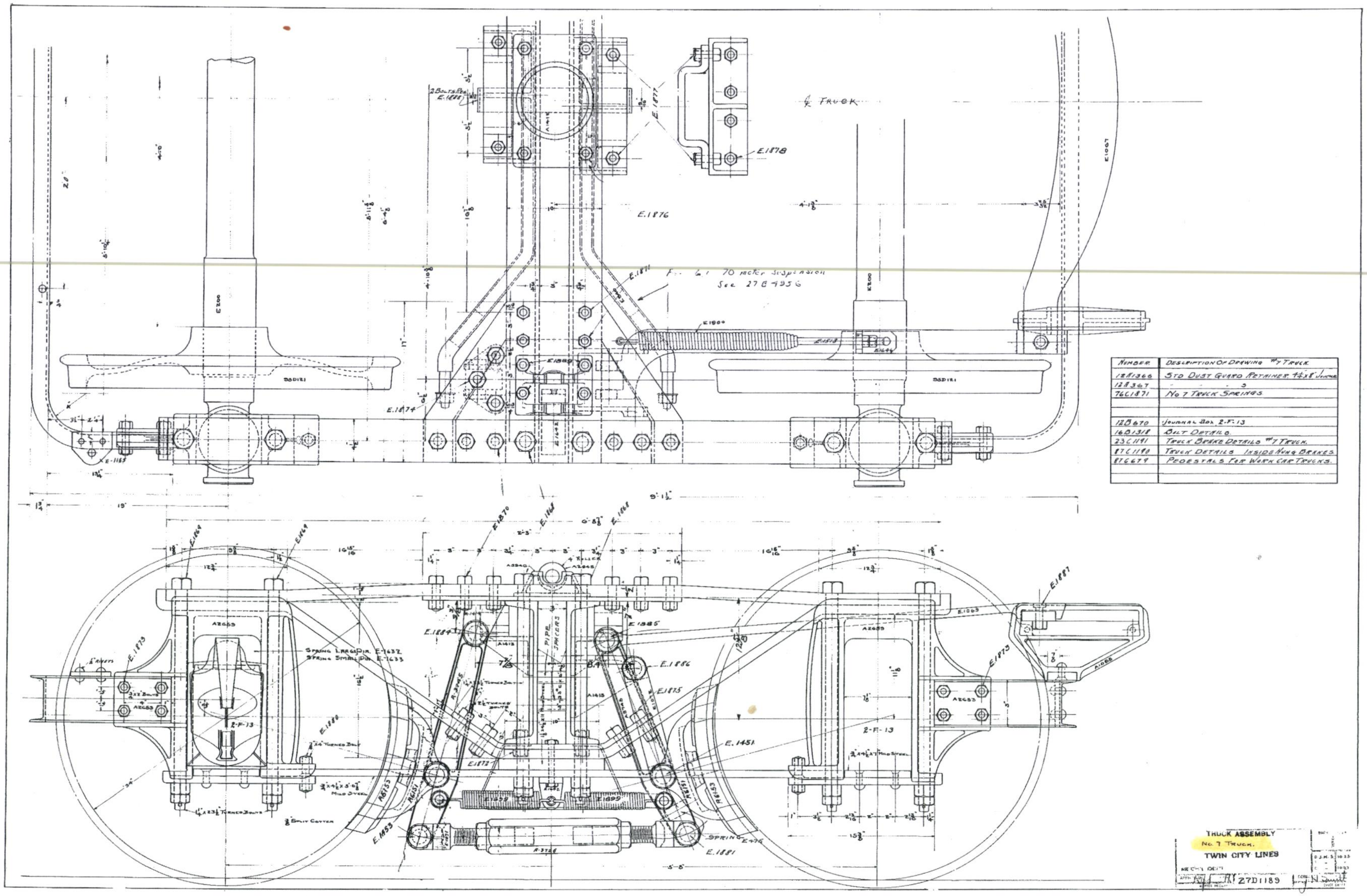
DRWGS FOR No. 7 TRUCKS.	
87D192	ASSEMBLY.
87C679	PEDESTALS.
87B193	CENTER PLATE.
87B478	SIDE BEARING.
87A737	GUSSET PLATES.
12B670	JOURNAL BOX.

TRUCK ASSEMBLY
No. 7 TRUCK.
TWIN CITY LINES
MECH'L DEPT.

BACK AHEAD

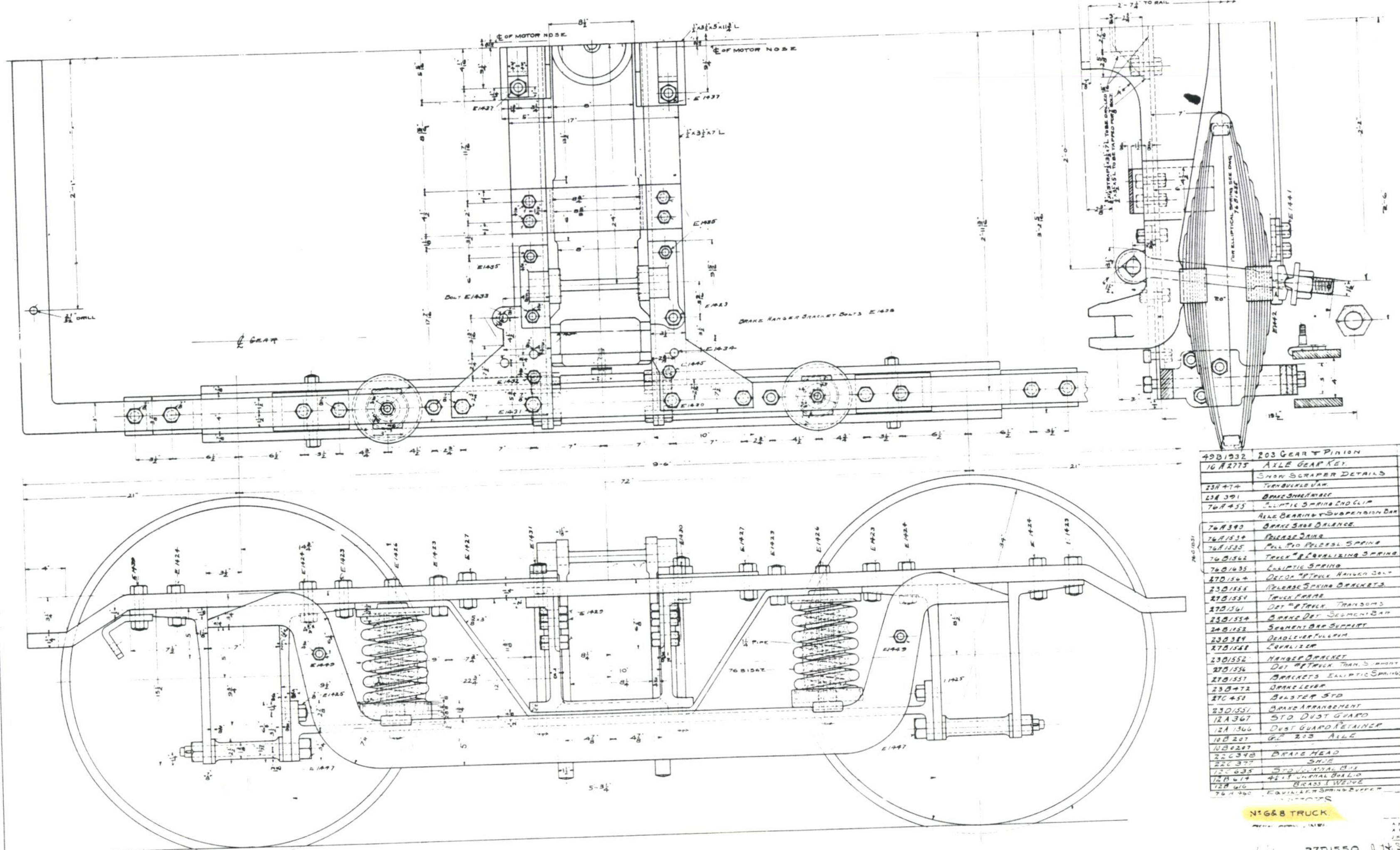
D. A.W.B. 8-9-09
T. A.W.B. 8-12-09
C. J.H.S. 8-16-09

APPROVED L. J. Smith | 27D192. | J. H. Smith


¼ Truck
E.1878
E.1876
E.1877
E.1871
For G.E. 70 motor suspension See 27 B 4956
E.1900
E.1518
E.1644
E.200
E.1067
SSD121
E.1889
E.1874
E.1165
E.1873
A2653
Spring Large Dia. E.1632
Spring Small Dia. E.1633
2-F-13
E.1884
E.1885
E.1886
E.1875
E.1872
Pipe Spacers
E.1451
E.1453
E.1881
E.1887
Spring E476
Split Cotter
Turned Bolts
Mild Steel

Number	Description Of Drawing #7 Truck.
12A1366	Std Dust Guard Retainer. 4¼x8" Journal
12A367	" " " 5
76C1871	No 7 Truck Springs
12B670	Journal Box 2-F-13
16B1318	Bolt Details.
23C1191	Truck Brake Details #7 Truck.
87C1190	Truck Details Inside Hung Brakes
87C6679	Pedestals For Work Car Trucks.

TRUCK ASSEMBLY
No. 7 Truck.
TWIN CITY LINES
MECH'L DEPT.
D. J. M. S. 10-23
10-23
27D1189



℄ OF MOTOR NOSE
℄ OF MOTOR NOSE
BRAKE HANGER BRACKET BOLTS E1438
BOLT E1433
℄ GEAR
½ DRILL
TO RAIL
FOR ELLIPTICAL SPRING SEE DWG 76B1635
E1431
E1435
E1437
E1434
E1432
E1430
E1425
E1424
E1423
E1426
E1427
E1429
E1447
E1441
E1442
E1445
76B1562
1¼ PIPE
9'-6"
72"
21"
5'-3¼"
34"
10"
76C1831

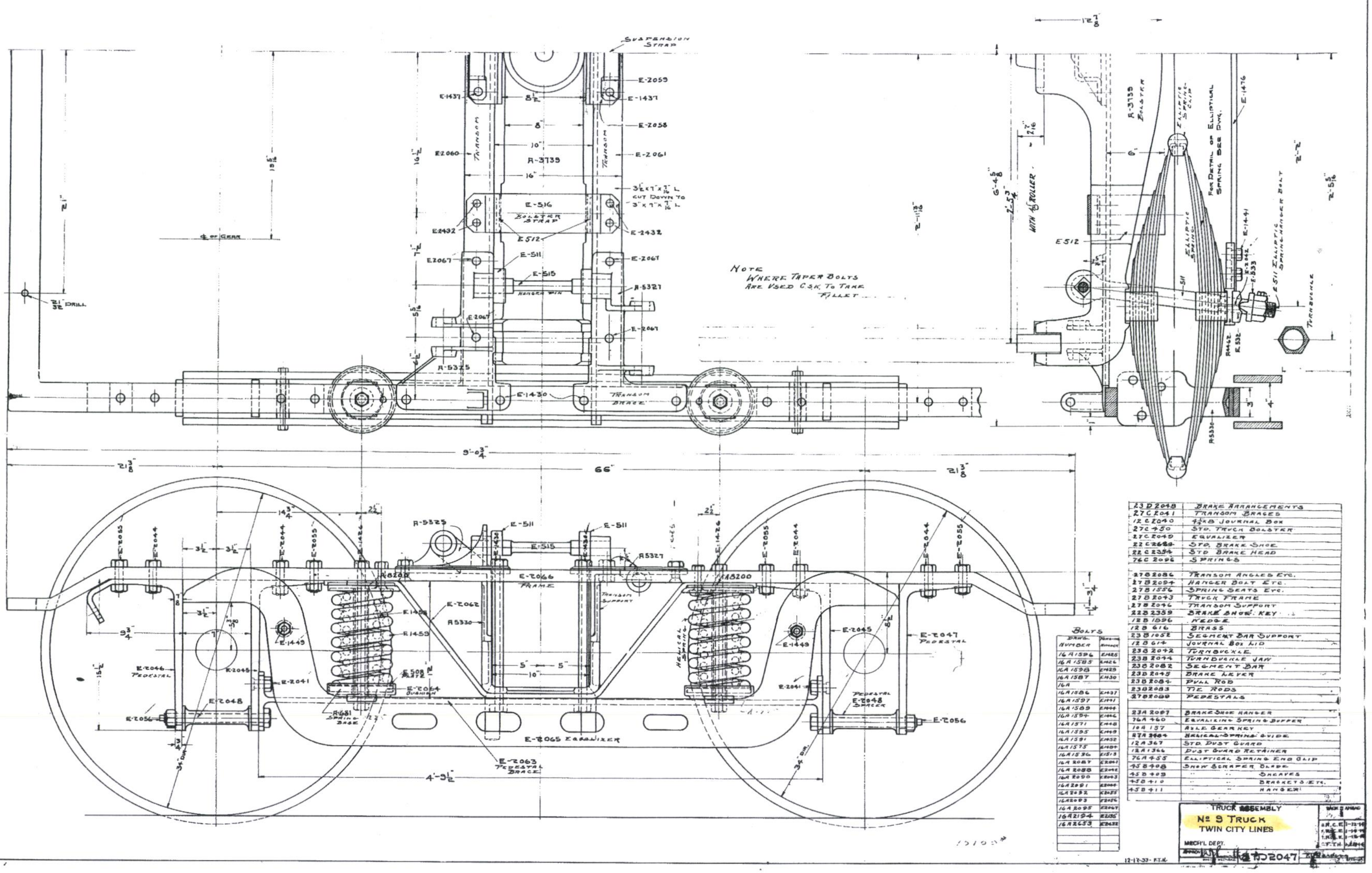
49B1932	203 GEAR & PINION	8
16A2775	AXLE GEAR KEY.	13
	SNOW SCRAPER DETAILS	6
23A474	TURNBUCKLE JAW.	14
23A391	BRAKE SHOE HANGER	14
76A455	ELLIPTIC SPRING END CLIP	13
	AXLE BEARING & SUSPENSION BAR	4
76A390	BRAKE SHOE BALANCE.	13
76A1534	RELEASE SPRING	13
76A1535	PULL ROD RELEASE SPRING	13
76B1562	TRUCK #8 EQUALIZING SPRING	12
76B1635	ELLIPTIC SPRING	12
27B1564	DET. OF #8 TRUCK HANGER BOLT	12
23B1555	RELEASE SPRING BRACKETS.	11
27B1554	TRUCK FRAME.	11
27B1561	DET #8 TRUCK. TRANSOMS	10
23B1554	BRAKE DET SEGMENT BAR	7
24B1152	SEGMENT BAR SUPPORT	10
23B389	DEAD LEVER FULCRUM.	10
27B1558	EQUALIZER	9
23B1552	HANGER BRACKET.	10
27B1556	DET #8 TRUCK. TRAN. SUPPORT	11
27B1557	BRACKETS ELLIPTIC SPRINGS	11
23B472	BRAKE LEVER.	12
27C450	BOLSTER STD	7
23D1551	BRAKE ARRANGEMENT	2
12A367	STD. DUST GUARD	13
12A1366	DUST GUARD RETAINER	13
10B207	G.E. 203 AXLE	8
10B0207		8
22C348	BRAKE HEAD	5
22C377	SHOE	5
12C635	STD JOURNAL BOX	5
12B614	4¼ x 8" JOURNAL BOX LID	8
12B616	BRASS & WEDGE	9
76A460	EQUALIZER SPRING BUFFER	14

Nº 6 & 8 TRUCK.

A.K.	3-28-09
A.K.	3-29-09
J.H.S.	4-10-09

27D1550 J. H. Smith
CHIEF DRAFTSMAN

AVERY®c
PV119ED


SUSPENSION STRAP
E-2059
E-1437
E-2058
E-2061
E-2060
TRANSOM
R-3739
8½"
8"
10"
16"
16½"
19⅝"
21"
℄ OF GEAR
21/32 DRILL
E-516 BOLSTER STRAP
E2432
E-512
E-511
E-515
HANGER PIN
E2067
R-5327
R-5325
E-1430
TRANSOM BRACE
9'-0¾"
66"
21⅜"
14¾"
3½"
2½"
E-2055
E-2044
E-1426
E-2066 FRAME
E-2062
R5330
E-1453
TRANSOM SUPPORT
A5200
HELICAL SPRING
E-2045
E-2047 PEDESTAL
E-1449
E-2046 PEDESTAL
E-2041
E-2048
E-2056
R-681 SPRING BASE
E-2054 SPACER
PEDESTAL E-2048 SPACER
E-2065 EQUALIZER
E-2063 PEDESTAL BRACE
4'-3½"
34" DIA.
5"
10"
12⅞"
R-3739 BOLSTER
ELLIPTIC SPRING CLIP
FOR DETAIL OF ELLIPTICAL SPRING SEE DWG.
E-1476
E-1441
E-511 ELLIPTIC SPRING HANGER BOLT
TURNBUCKLE
WITH ⅛" ROLLER
6'-4⅝"
2'-5¾"
2'-11⅛"
2'-2"
2'-5⅛"
E 512
R5330

NOTE
WHERE TAPER BOLTS
ARE USED CSK. TO TAKE
FILLET

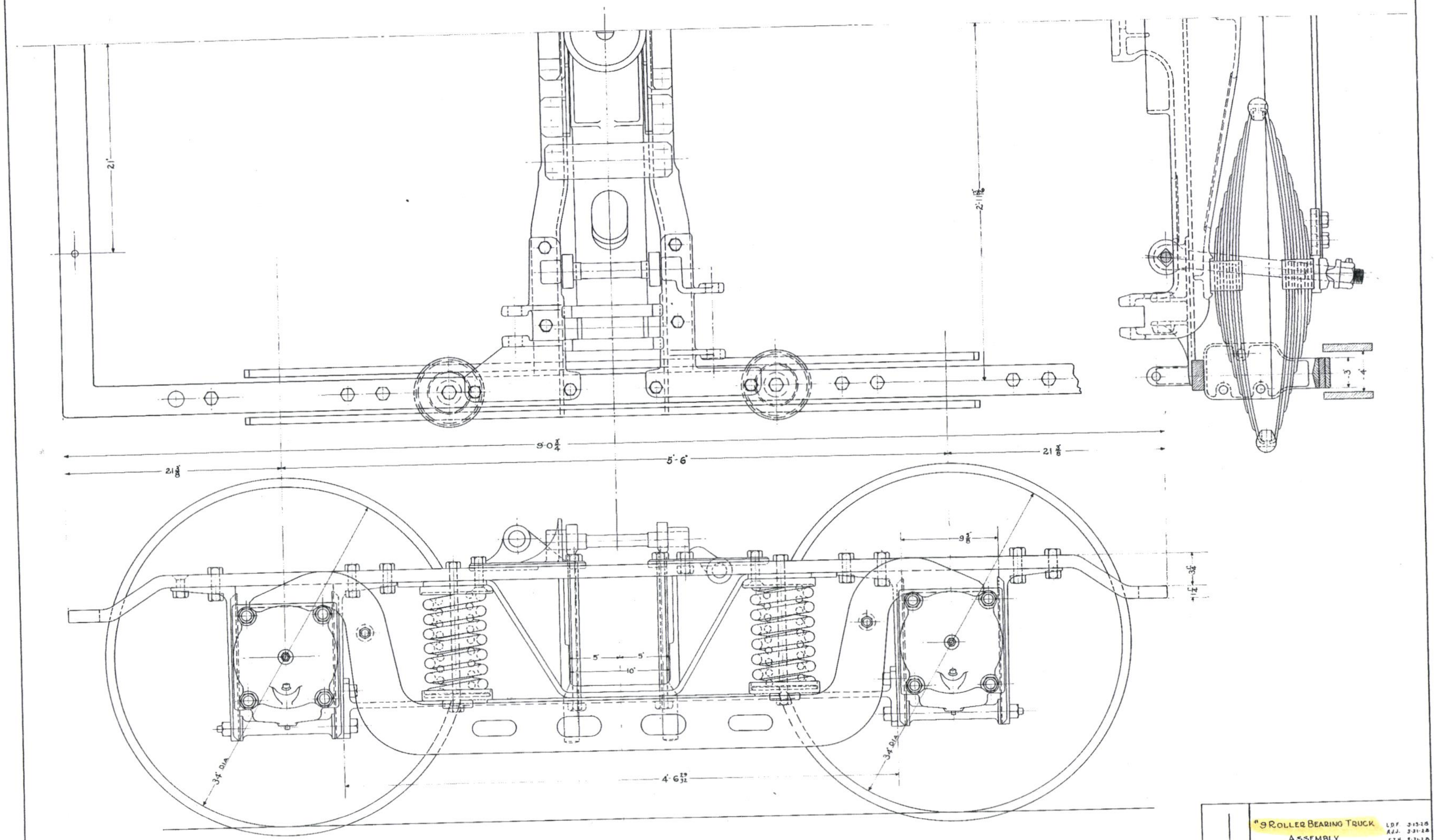
23D2048	BRAKE ARRANGEMENTS
27C2041	TRANSOM BRACES
12C2040	4¼×8 JOURNAL BOX
27C450	STD. TRUCK BOLSTER
27C2049	EQUALIZER
22C2684	STD. BRAKE SHOE
22C2354	STD BRAKE HEAD
76C2096	SPRINGS
27B2086	TRANSOM ANGLES ETC.
27B2094	HANGER BOLT ETC.
27B1556	SPRING SEATS ETC.
27B2043	TRUCK FRAME
27B2046	TRANSOM SUPPORT
22B2359	BRAKE SHOE KEY
12B1896	WEDGE
12B616	BRASS
23B1052	SEGMENT BAR SUPPORT
12B614	JOURNAL BOX LID
23B2042	TURNBUCKLE
23B2044	TURNBUCKLE JAW
23B2082	SEGMENT BAR
23B2045	BRAKE LEVER
23B2084	PULL ROD
23B2083	TIE RODS
27B2089	PEDESTALS
23A2097	BRAKE SHOE HANGER
76A460	EQUALIZING SPRING BUFFER
10A157	AXLE GEAR KEY
27A [illegible]	HELICAL SPRING GUIDE
12A367	STD. DUST GUARD
12A1366	DUST GUARD RETAINER
76A455	ELLIPTICAL SPRING END CLIP
45B408	SNOW SCRAPER BLADE
45B409	" " SHEAVES
45B410	" " BRACKETS ETC.
45B411	" " HANGER

BOLTS

DRWG. NUMBER	FORGING NUMBER
16A1596	E1425
16A1585	E1426
16A1598	E1429
16A1587	E1430
16A	
16A1586	E1437
16A1597	E1441
16A1589	E1444
16A1594	E1446
16A1571	E1448
16A1595	E1449
16A1591	E1452
16A1575	E1484
16A1536	E1513
16A2087	E2041
16A2088	E2042
16A2090	E2043
16A2091	E2044
16A2092	E2055
16A2093	E2056
16A2095	E2067
16A2194	E2135
16A2653	E2432

12-17-33- F.T.K.

TRUCK ASSEMBLY
No 9 TRUCK
TWIN CITY LINES
MECH'L DEPT.
BACK ☐ AHEAD
[illegible]D2047

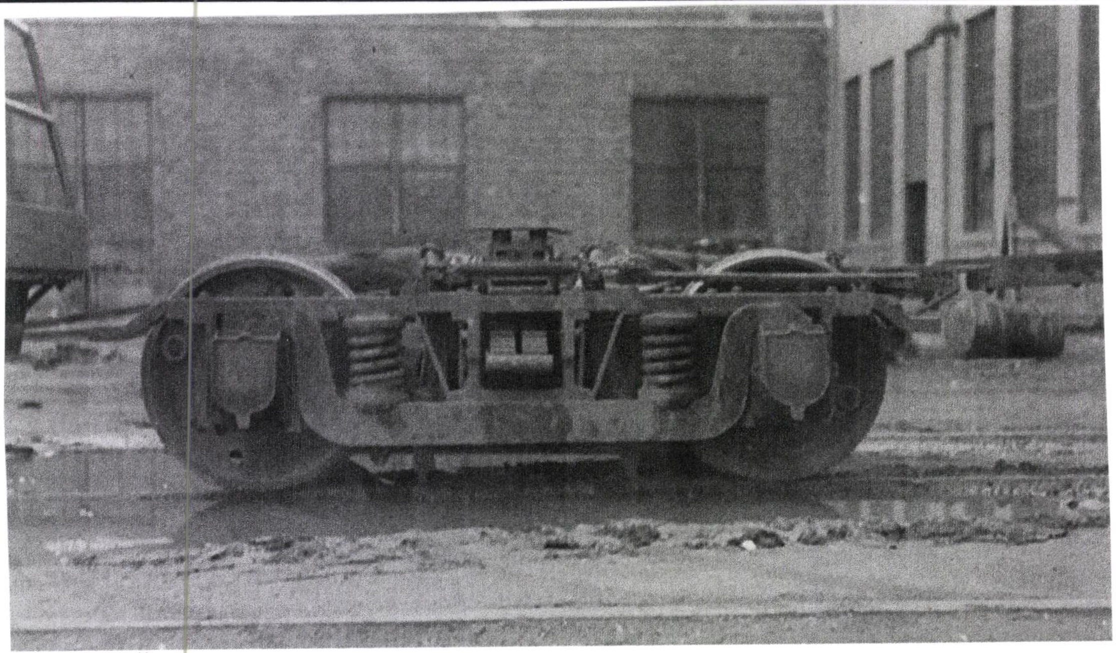

21"
2'-11⅝"
5'-0¾
5'-6"
21⅝
21⅝
9⅜
34" DIA
34" DIA
5"
5"
10"
4'-6 29/32
3
4
1½
3⅝

"9 ROLLER BEARING TRUCK
ASSEMBLY

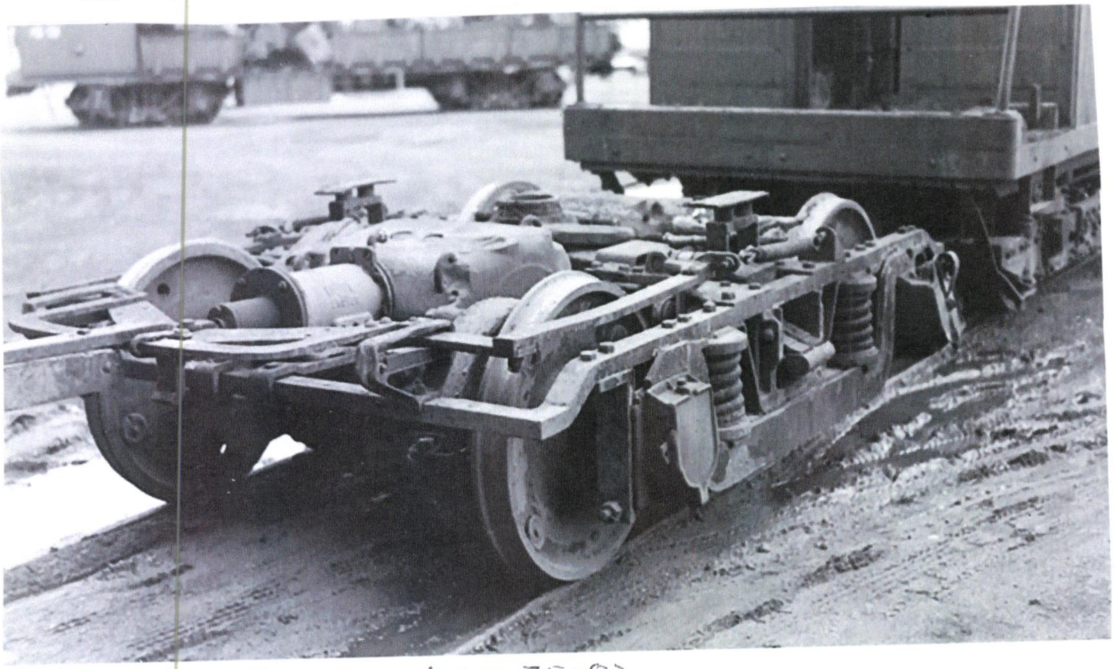
L.D.F. 3-13-28
A.J.J. 3-31-28
F.T.H. 3-31-28

W.J. #270-3728 F.T. Harding

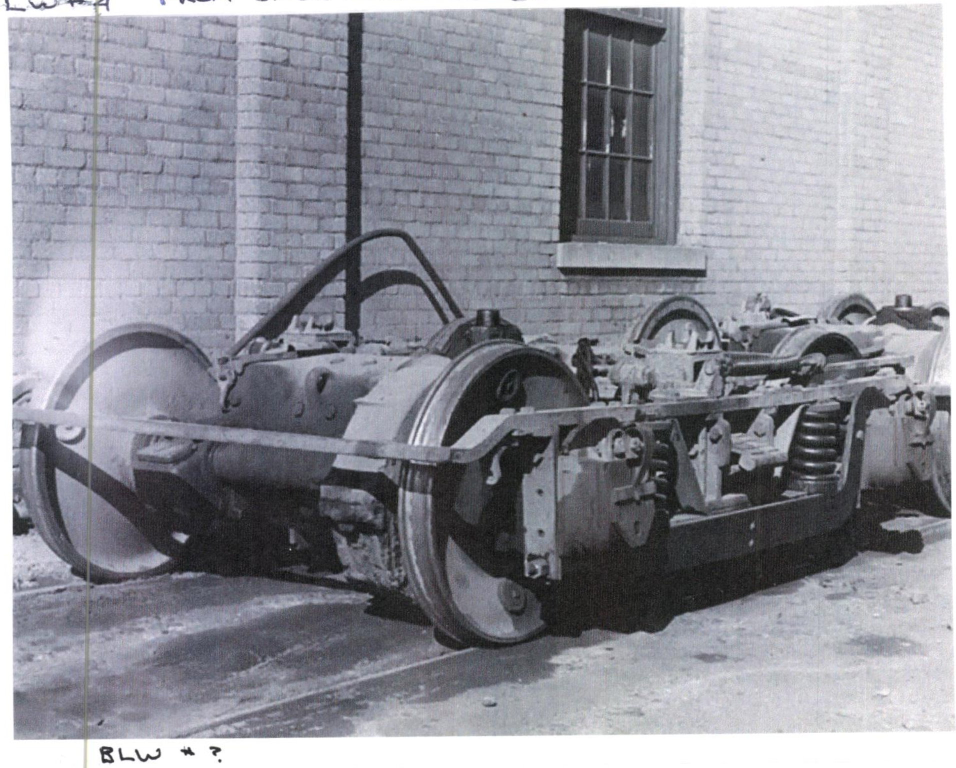
PV119ED AVERY™



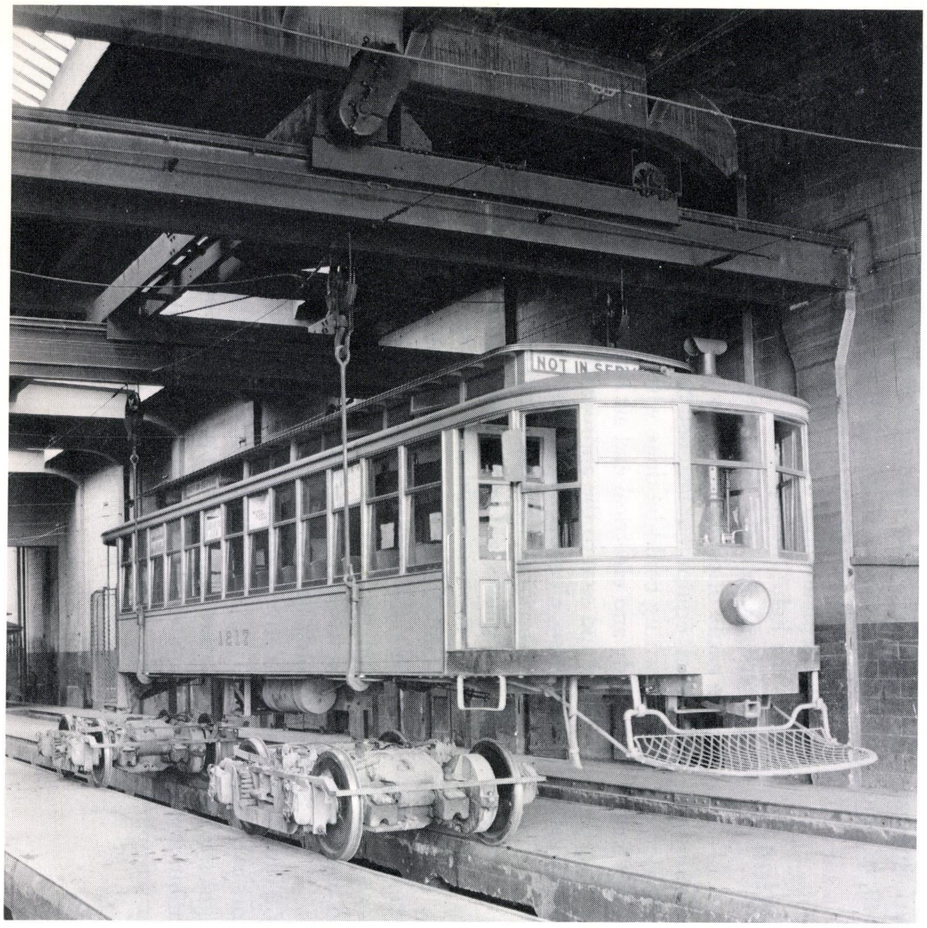
BLW #4



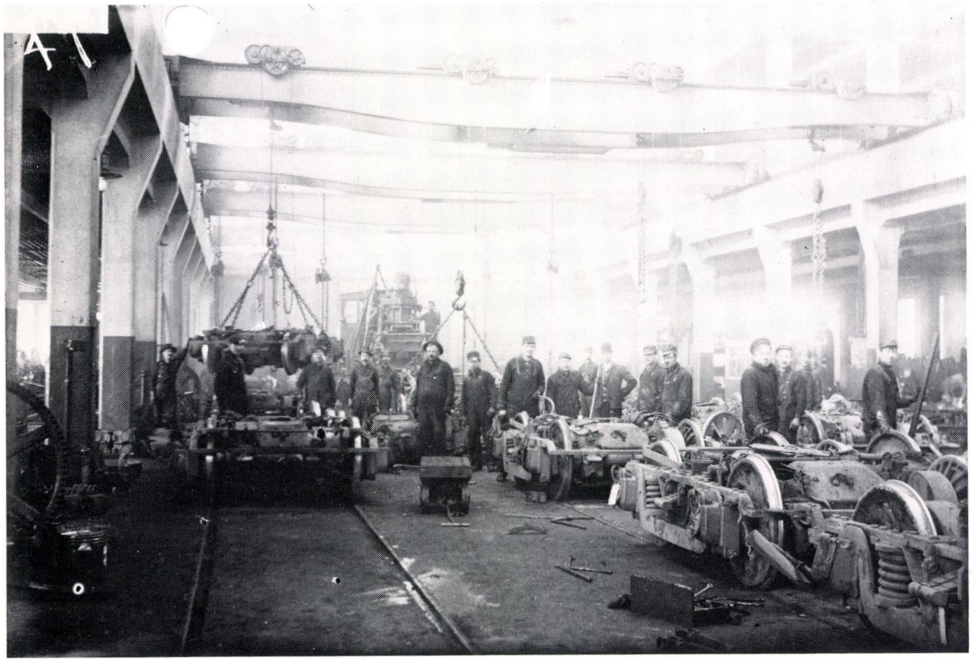
BLW #4 FROM SNOW PLOWS 75-82



BLW #?

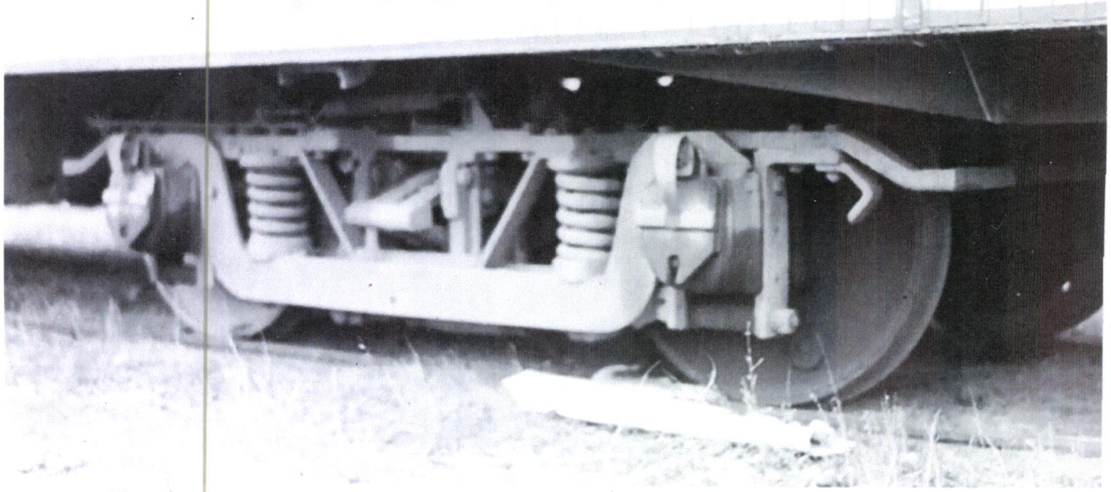


Above: Baldwin #5 trucks being removed from car 1217 in the general repair shop building at the Snelling Shops. (TCRT)

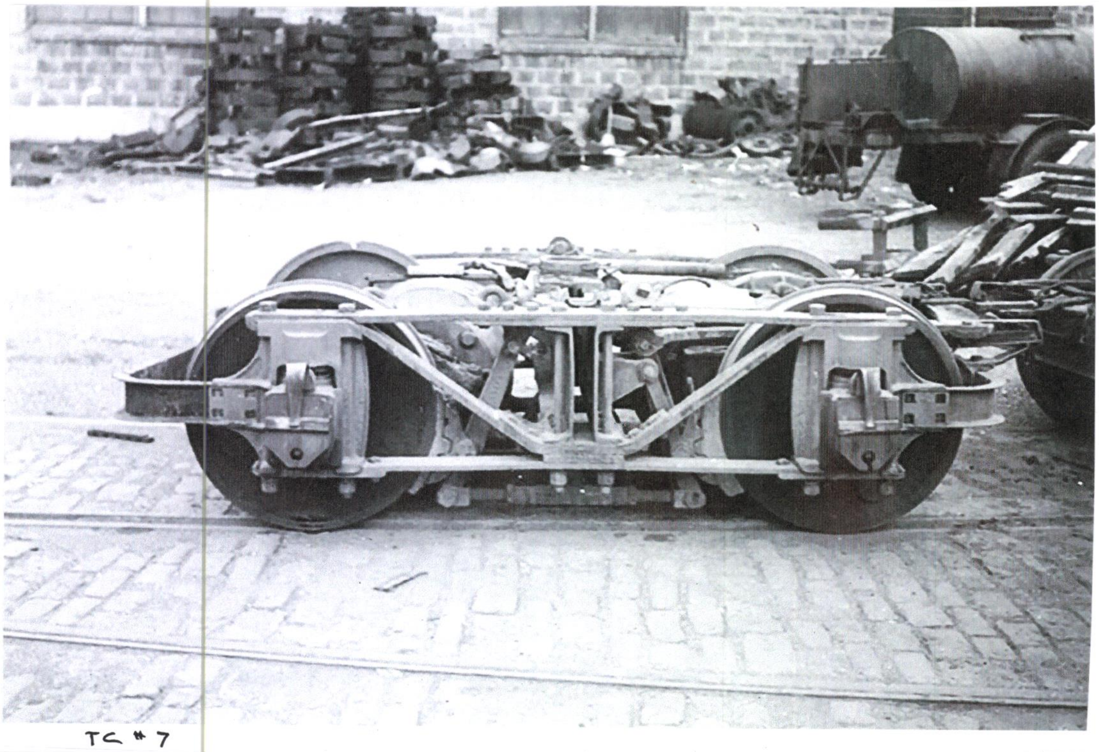


Interior of the machine shop building at the Snelling Shops with Baldwin #5 trucks being worked on. (TCRT)

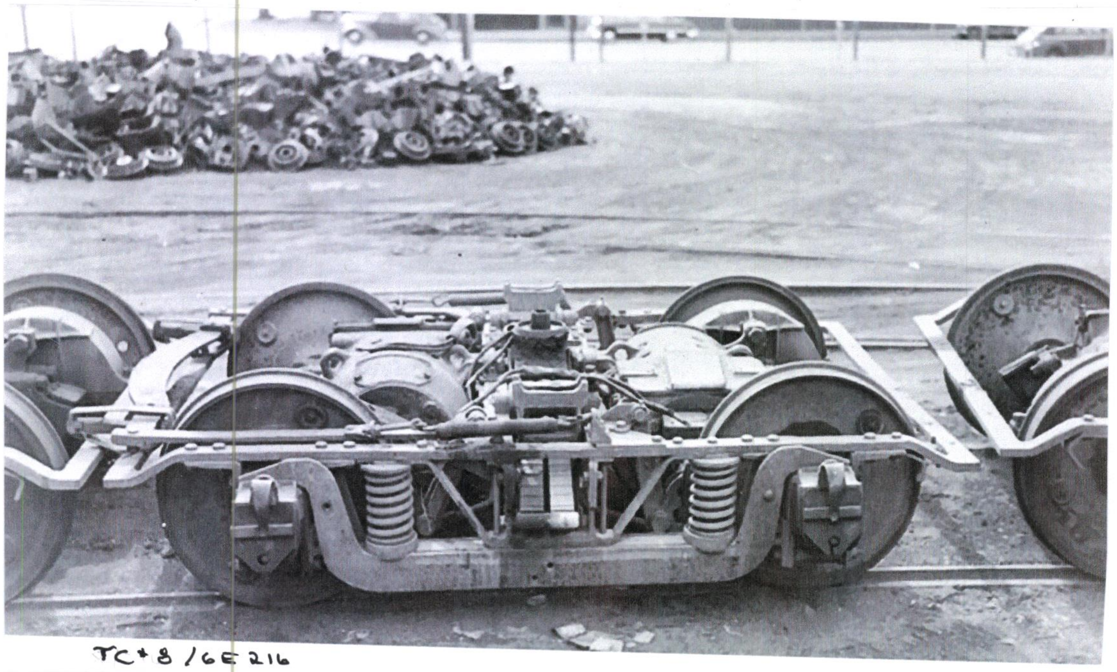
AVERY® POLY-VU



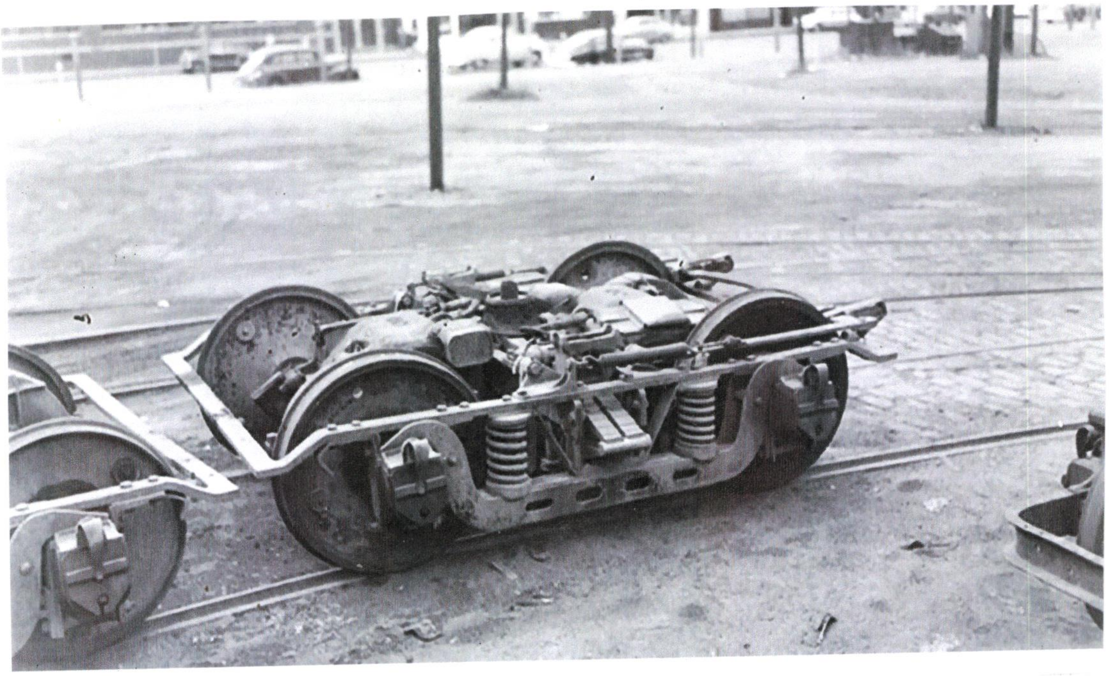
TC #6



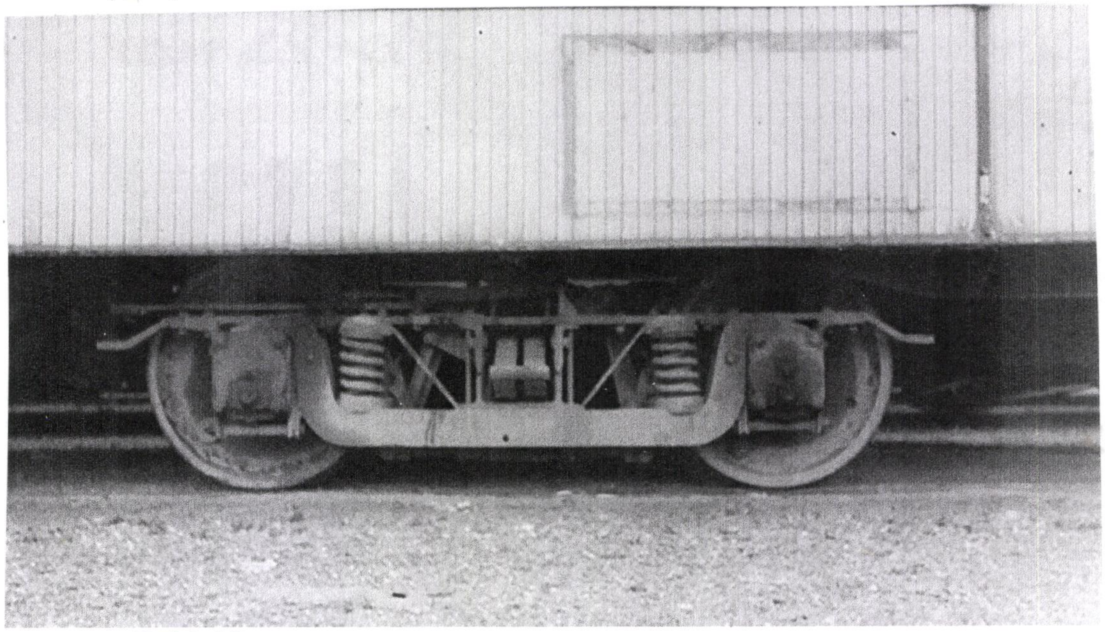
TC #7



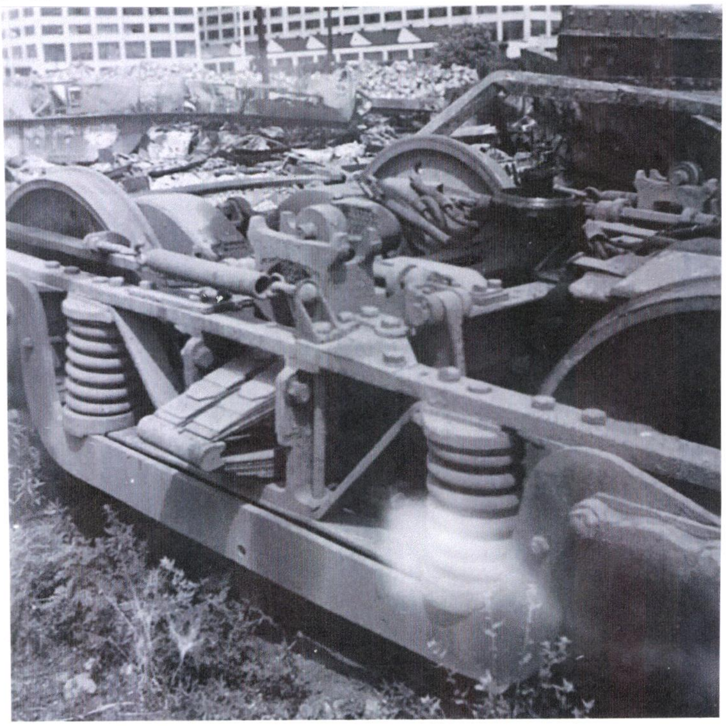
TC #8 / 6E 216



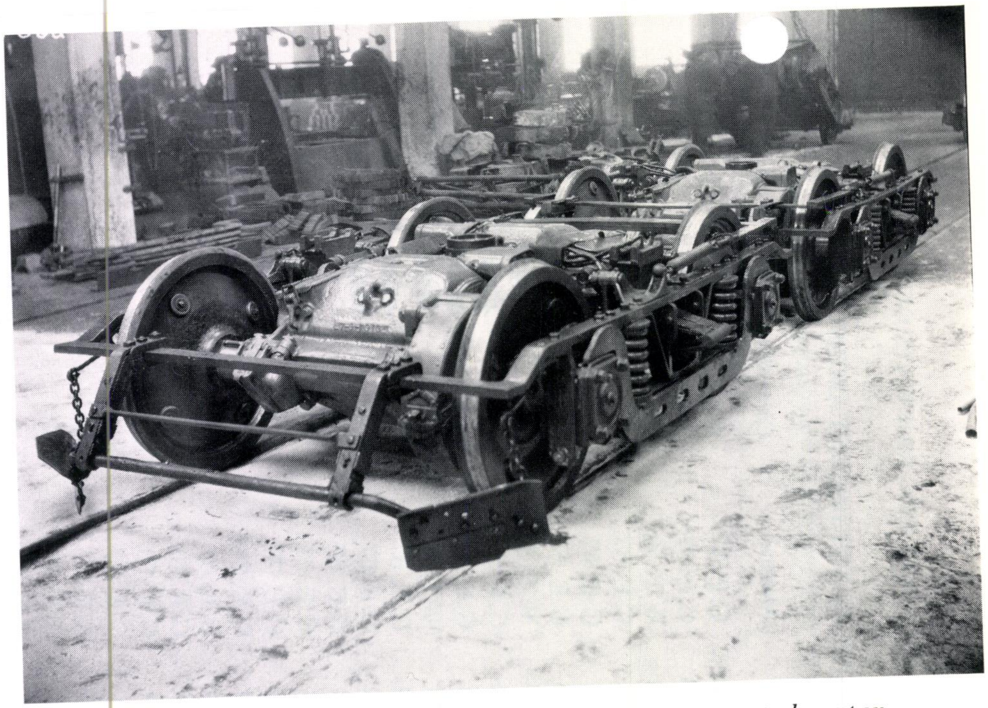
TC#9



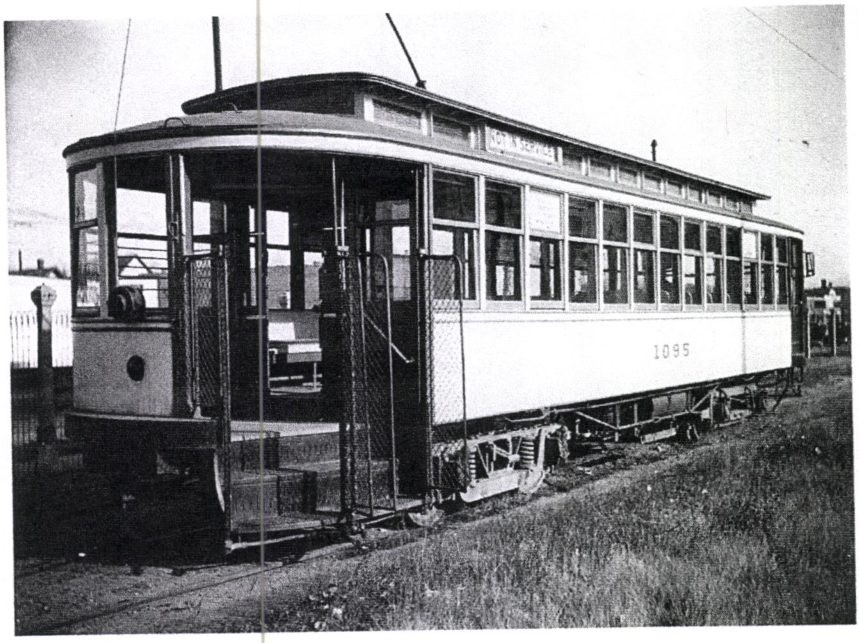
TC#8RB



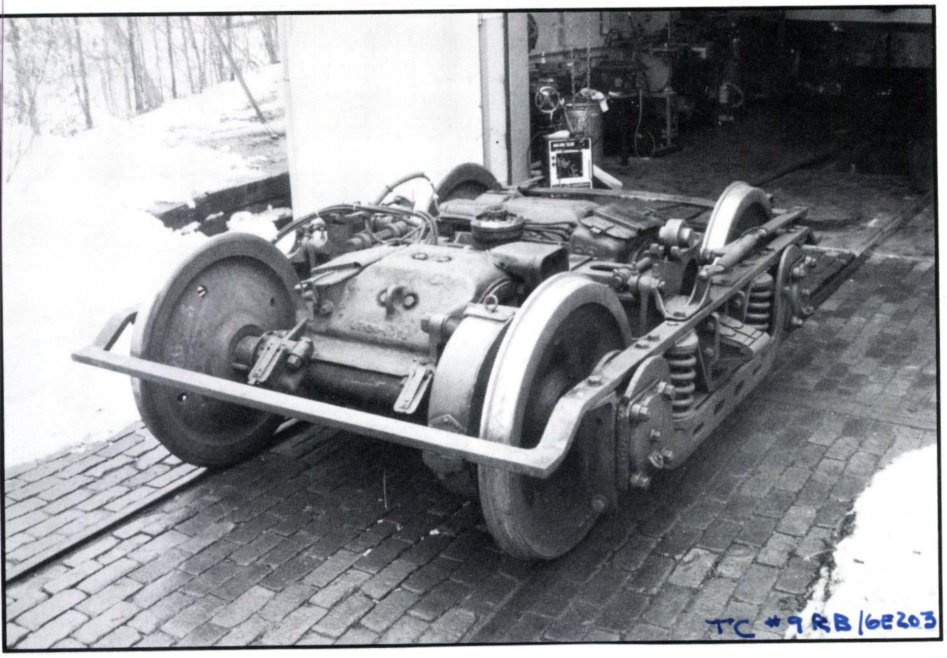
TC#8RB



Twin City #9 RB trucks newly built during 1928. Note the snow scraper attachment on the front truck. (TCRT)



Shifting of mechanical equipment really was flexible. Here is car 1095 with a Brill 04 front truck and Baldwin #1 rear truck. (TCRT)


TC #9RB/6E203

Twin City #9RB trucks: these were #9 trucks with roller bearing journals built new in 1928 for rebuilt cars 1254, 1266-1328.

Twin City #10 trucks: the first lightweight, inside frame, arch bar truck, 4'8" wheelbase, built in April, 1916, for cars 2000-2000A.

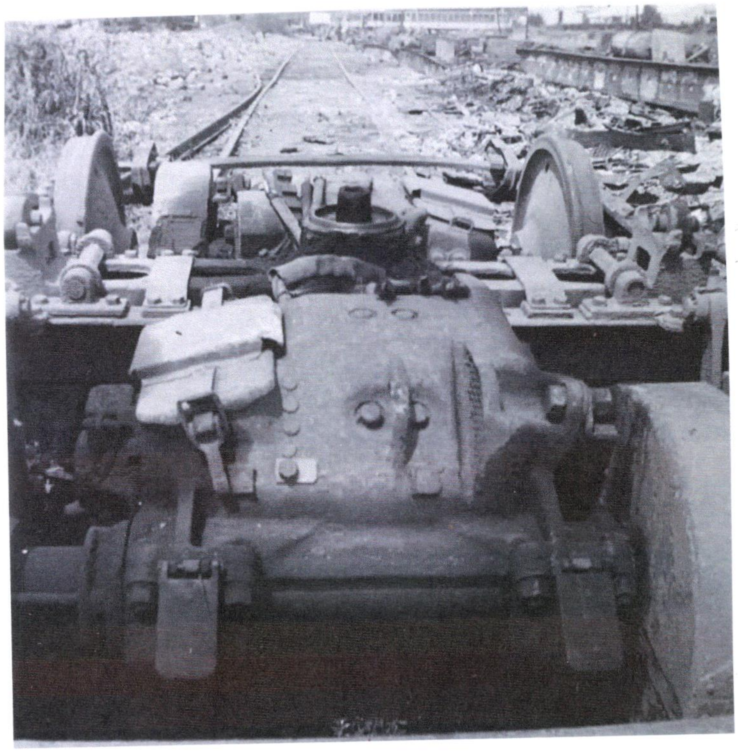
Twin City #11 trucks: an improved version of the #10 truck, 4'6" wheelbase, used without motors on Trailers 200-225 rebuilt in 1920, and with motors on cars 2002-2003 built in 1921.

Twin City #12 trucks: the final version of the lightweight, inside frame, arch bar truck, 4'6" wheelbase, equipped with Hyatt roller bearing journals. Later designated Twin City #12RB trucks. Used on cars built from March, 1925, through January, 1928. Twin City #12RB trucks were installed during 1928 on cars 2000-2003 replacing the older #10 and #11 trucks.

Twin City #12 trucks: apparently several successive modifications. Drawings noted

#12D May 1924

#12G Feb 1930


TC #8RB

WHEELS

33" diameter chilled cast-iron wheels were standard to 1910. Thereafter 34" diameter rolled-steel wheels were placed on all cars, passenger and service. Most older trucks were changed from 1911 onward to the 34" rolled-steel wheels. A company memorandum of August 1911 tells of wheels changed from 33" cast-iron to new 34" rolled-steel on many 1100's and 1200's up to 1287.

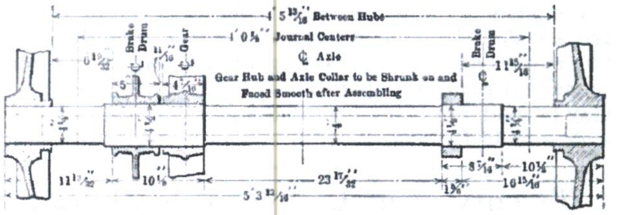
The lightweight trucks used 26" diameter Davis wheels. (28" diameter wheels were tested on 2023 in late 1937.)

AVERY®
PV119ED

Novel Truck for City Service

This Design, Which Is Being Tried Out by the Twin City Rapid Transit Company, Has Inside Journals and Band Brakes

A novel form of truck for city service has been developed by W. J. Smith, master mechanic Twin City Rapid Transit Company, and has been placed in service on the new light-weight cars that are being tried out on that company's lines. The major features of the construction are inside journal boxes and band brakes, the principal object of the new design being to obtain lighter weight than is practicable where the journals and truck frames are outside of the wheels. By placing the frames between the wheels it becomes possible to use lighter axles, and in addition some of the cross members of the truck can be made shorter and of correspondingly decreased weight.


4' 5 13/16'' Between Hubs
1' 0 3/4'' Journal Centers
℄ Axle
Brake Drum
℄ Gear
Gear Hub and Axle Collar to be Shrunk on and Faced Smooth after Assembling
Brake Drum
11 15/16''
5 3/16''
5
11 11/32
10 1/4
5' 3 11/16''
23 11/32''
1 3/8''
8 3/16
10 3/4
10 15/16

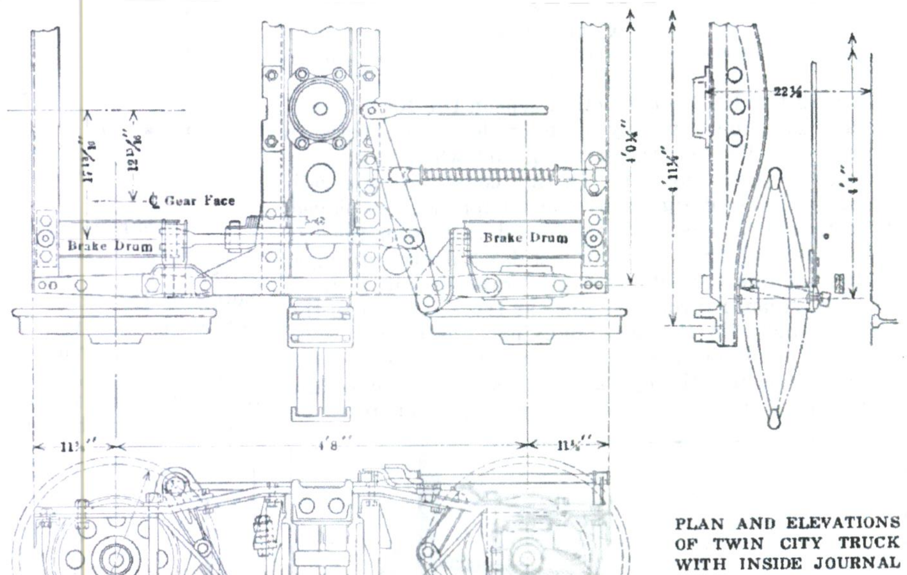
DETAIL OF AXLE FOR TWIN CITY TRUCK WITH INSIDE JOURNALS

An idea of the construction may be obtained from the accompanying illustrations, of which one shows views of the assembled truck and the other a detailed drawing of the axle. From the former it will be observed that the single pedestal casting at each wheel interlocks with one side of the journal box casting. The idea of this construction is to leave one side of the journal box free from bolts and to give access for packing the journal box, whose oil cellar is accessible from the end of the truck and not from the side, as is customary. To provide for movement between the truck frame and the journal box a small amount of play between the interlocked members is permitted. There is a rubber pad on top of the journal box, and this, when compressed, permits the box to slide upward slightly along the pedestal casting, along one side of which it is interlocked.

From experience with the trucks under actual operating conditions Mr. Smith states that this design and location for the journal box appear to be satisfactory in every way. The elliptic springs, which are hung by relatively long links from the transoms and which furnish the sole support for the truck bolsters, are 32 in. long, the length being easily attained by extending the springs out between the wheels. Naturally, the riding qualities of the truck are good.

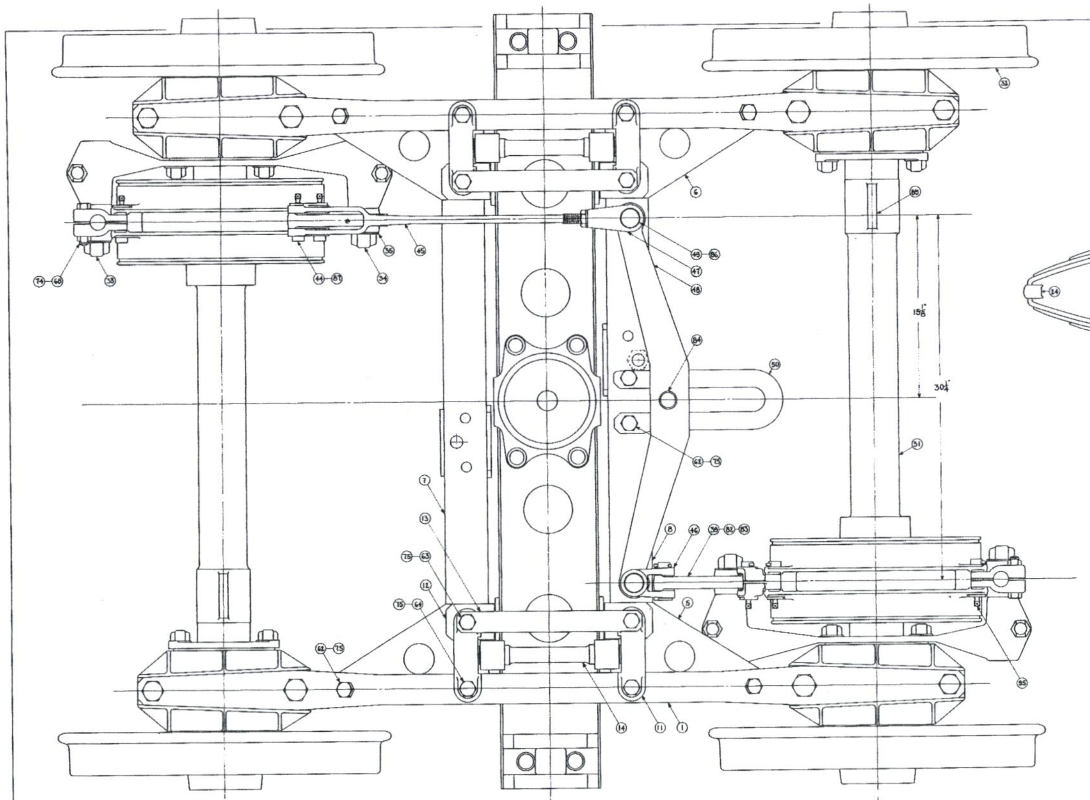
Band brakes instead of the customary brakeshoes are provided at either side just inside of each wheel, making eight brakes in all. These give a total contact surface of about 800 sq. in. In practice this brake has been found to be efficient, smooth and noiseless.

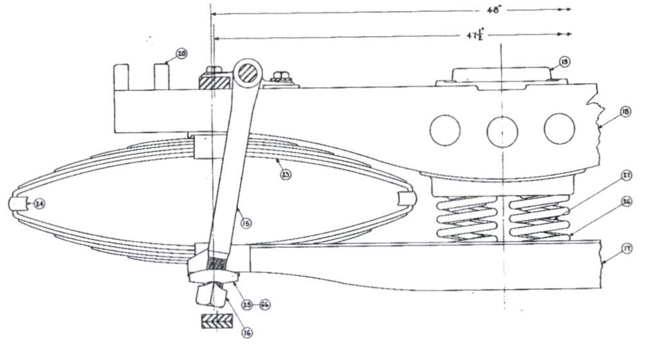
Complete with wheels and axles the weight of one truck is 3200 lb. The weight of one truck together with two motors and the necessary gear case, oil, grease, etc., to make it ready for operation is 5200 lb. The trucks, it may be said, are being operated under cars that are 9 ft. wide and 46 ft. long.

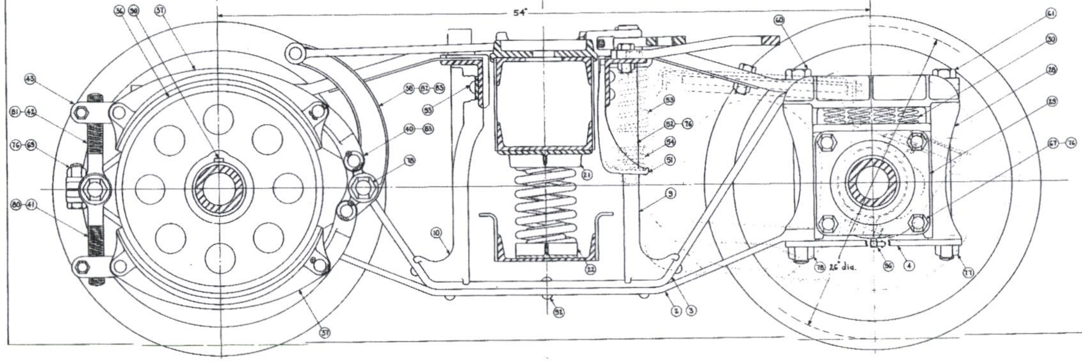


PLAN AND ELEVATIONS OF TWIN CITY TRUCK WITH INSIDE JOURNAL BOXES

TWIN CITY #10 TRUCK







List of Parts & Drawings

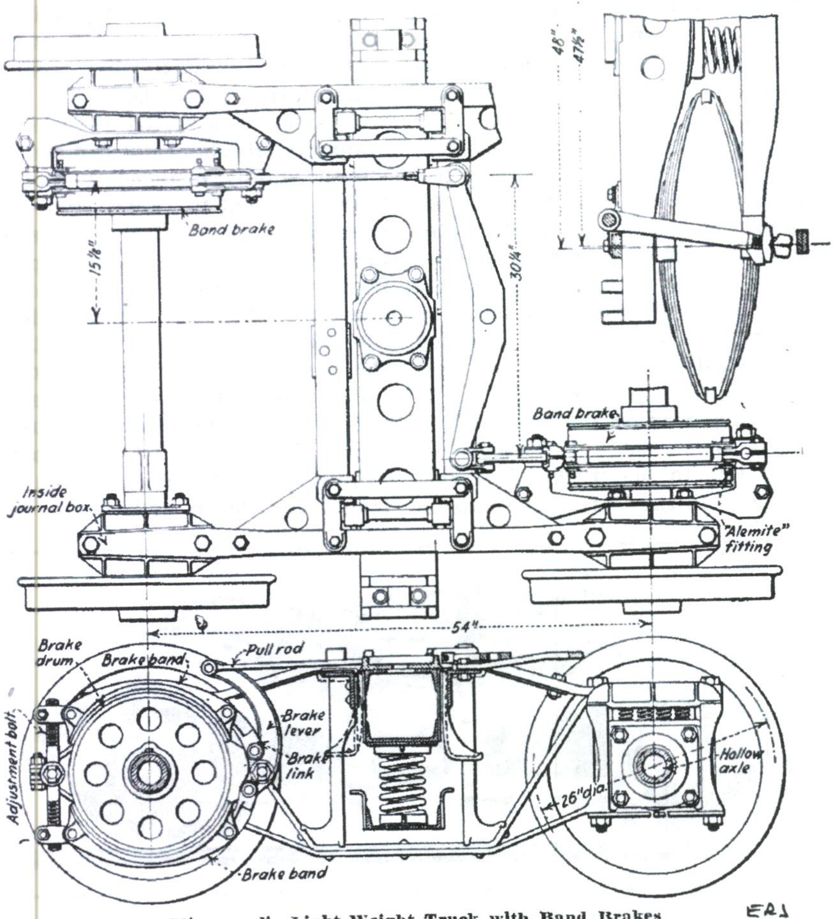
Index No.	Name	No. Req'd	Part No.	Dwg. No.	Index No.	Name	No. Req'd	Part No.	Dwg. No.
1	Upper frame member	2	E-2822	27C-3113	46	Brake-lever clevis	1	A-7581	23B-3072
2	Diagonal " "	2	E-2823	"	47	Pull-rod "	1	A-7335	23B-2910
3	Lower " "	2	E-2824	"	48	Equalizer bar	1	E-2491	23B-2890
4	Pedestal-clamping strap	2	E-2825	"	49	" " pin	2	E-2502	23A-2773
5	Gusset plate, R.H.	2	E-2817	27C-3110	50	Guide bar	1	E-2492	23B-2906
6	" " , L.H.	2	E-2818	"	51	Motor-suspension bracket	2	A-7645	27C-3120
7	Transom, rear	1	E-2815	"	52	" " bolt	2	E-2835	16A-3121
8	" , front	1	E-2816	"	53	" " spring, long	2	E-2836	76A-3122
9	Frame post, R.H.	2	A-7634	27C-3106	54	" " " , short	2	E-2837	"
10	" " L.H.	2	A-7635	"	55				
11	Bearing block	4	A-7636	27B-3108	56				
12	Chafing plate	4	E-2819	27C-3110	57				
13	Tie strap	2	E-2820	"	58				
14	Spring-plank hanger pin	2	E-2371	27B-3111	59				
15	" " " bolt	4	E-2370	27B-2542	60	Pedestal bolt (1¼")	4	E-2827	16A-3117
16	" " " " nut	4	E-2833	"	61	" " (1⅛")	4	E-2828	16A-3118
17	Spring plank	1	E-2832	27B-3111	62	Bolt (⅞" x 2")	6	E-2390	16A-2566
18	Bolster	1	E-2831	27D-2409	63	" (⅞" x 2½")	4	E-2839	16A-3128
19	" center bearing plate	1	A-6281	"	64	" (⅞" x 3")	4	E-2386	16A-2563
20	" side " block	2	A-6282	"	65				
21	Upper helical-spring seat	1	A-7055	"	66	Spring-seat bolt & nut	4	E-2042	16A-2088
22	Lower " " "	1	A-7056	27B-3111	67	Stud for bearing cage (1" x 7")	16	E-2838	12D-3057
23	Elliptical spring	2	E-2834	76A-3112	68	Bolt (¾" x 3")	4	E-2840	16A-3131
24	" " clip	4	A-7638	27A-3109	69	" (1" x 3⅜")	4	E-2841	16A-3132
25	" " seat	2	E-2373	27B-2547	70				
26	Large helical spring	2	E-2475	76B-3115	71				
27	Small " "	2	E-2476	"	72				
28	Pedestal	4	A-7633	27D-3105	73				
29	Roller bearing, assembled			10B-3061	74	⅝" hex. grip nut, tapped ¾"	4		
	Bearing cage	4	A-7563	12D-3057	75	¾" " " " " ⅞"	14		
	" " end	2	A-7565	12D-3059	76	⅞" " " " , " 1"	20		
	" " " & brake-band hanger	2	A-7564	"	77	1" " " " , " 1⅛"	4		
	"Hyatt" roller bearing #320	4			78	1⅛" " " " , " 1¼"	8		
	Spacing ring	4	E-2762	12C-3058	79				
	Thrust "	4	E-2764	"	80	Bushing	4	E-2772	23D-3104
	" collar	4	E-2763	"	81	"	2	E-2773	"
30	Bearing box spring	48	E-2826	76B-3115	82	"	2	E-2774	"
31	Axle	2	E-2761	10B-3061	83	"	10	E-2775	"
32	Wheel	4	E-2830	95C-3114	84	"	3	E-2617	23A-2900
33	Brake-band hanger pin, long	2	E-2765	12C-3058	85				
34	" " " " , short	2	E-2766	"	86	Cotter pin, (5/32" x 3")	2		
35	" " " " washer	4	E-2767	"	87	" " (¼" x 1½")	14		
36	Brake drum	2	A-7637	23C-3107	88				
37	" band	4	A-7629	23D-3104	89	Key, short	2	E-2844	10A-3134
38	" lever, R.H.	1	A-7630	"	90	" , long	2	E-2845	"
39	" " , L.H.	1	A-7631	"	91				
40	" link	4	A-7569	"	92	Rivet, ½" button hd.	10		
41	Eye-bolt, female	2	E-2812	"	93	" , ⅝" " "	10		
42	" " , male	2	E-2813	"	94				
43	" " clamp	4	A-7632	"	95	"Alemite" fitting (⅛" - 90° angle)	14		
44	Brake pin	14	E-2814	"	96	" " (¼" " ")	4		
45	Pull rod	1	E-2789	23B-3072	97				

CHANGE DATES

ROLLER BEARING TRUCK #12

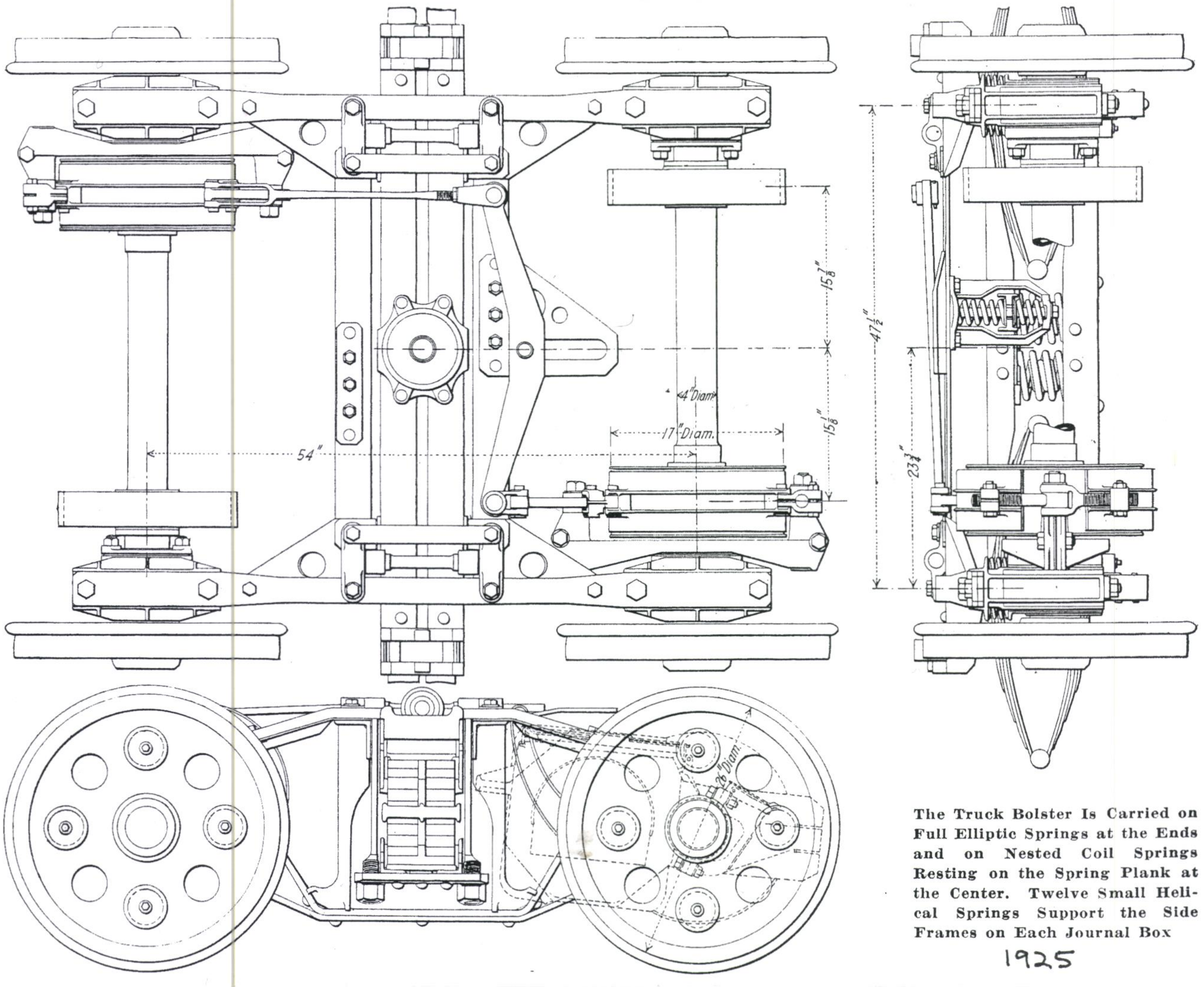
L.D.F. 7-26-23
" 7-28-23

27D-3116


48"
47½"
Band brake
15⅞"
30¼"
Band brake
Inside journal box
"Alemite" fitting
54"
Brake drum
Brake band
Pull rod
Brake lever
Brake link
Adjustment bolt
Hollow axle
26" dia.
Brake band

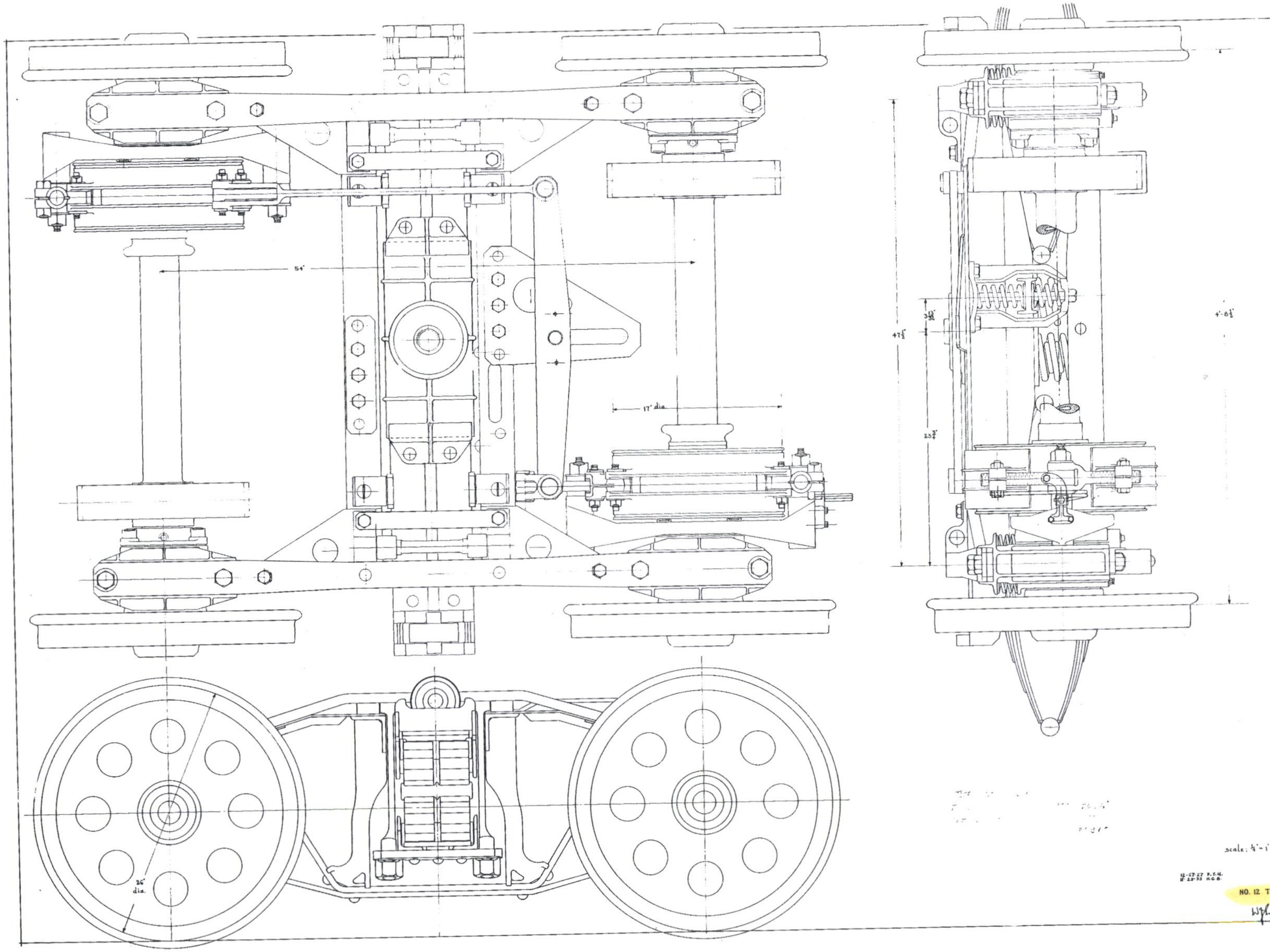
Minneapolis Light-Weight Truck with Band Brakes and Hollow Axles

ERJ
9-1923


15⅝"
15⅝"
4" Diam.
17" Diam.
54"
47½"
23⅜"
26" Diam.

The Truck Bolster Is Carried on Full Elliptic Springs at the Ends and on Nested Coil Springs Resting on the Spring Plank at the Center. Twelve Small Helical Springs Support the Side Frames on Each Journal Box

1925


54'
17' dia
26' dia.
47½'
3 13/32'
23¾'
4'-8½'

scale: ¼'-1'

12-27-27 F.T.H.
11-23-33 H.G.B.

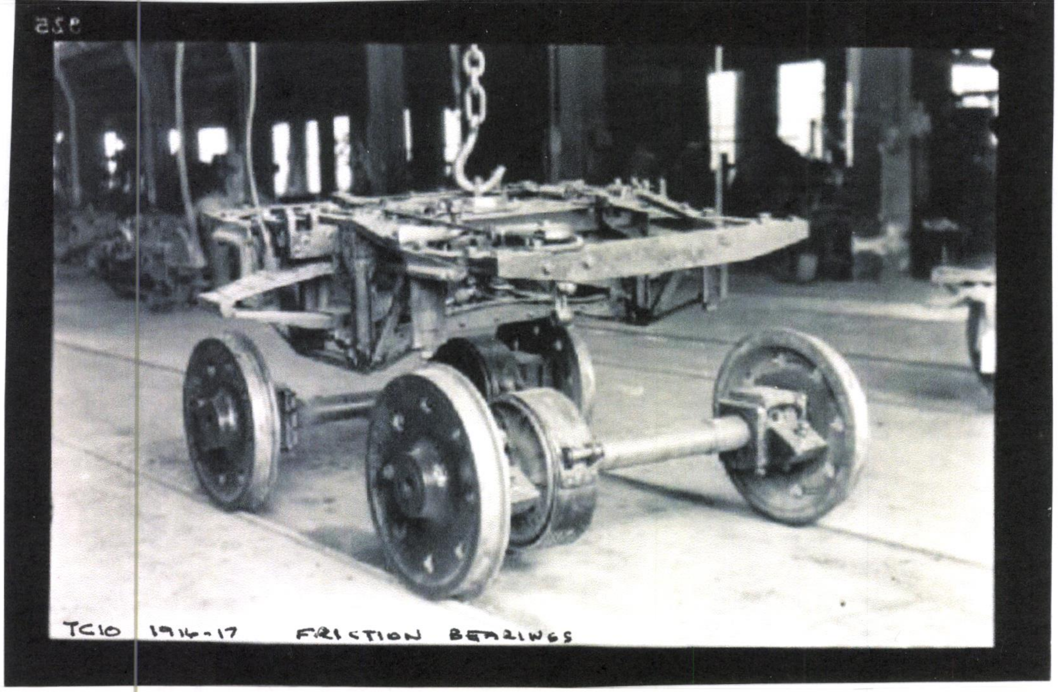
NO. 12 TRUCK ASSEMBLY

F.T.H. 12-3-26
12-6-26

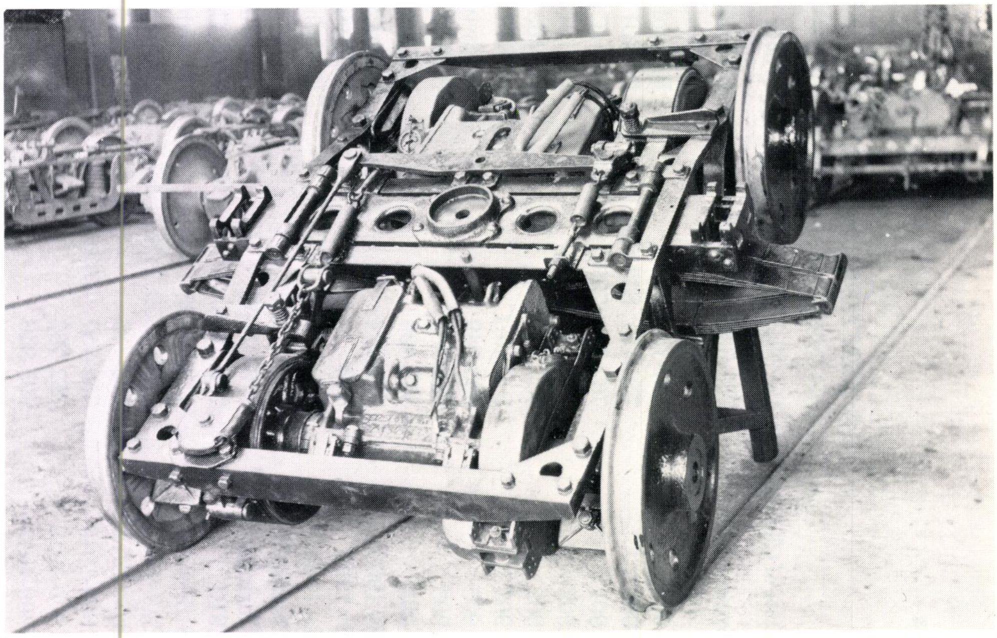
W.J. Smith D 12-101

F.T. Harding

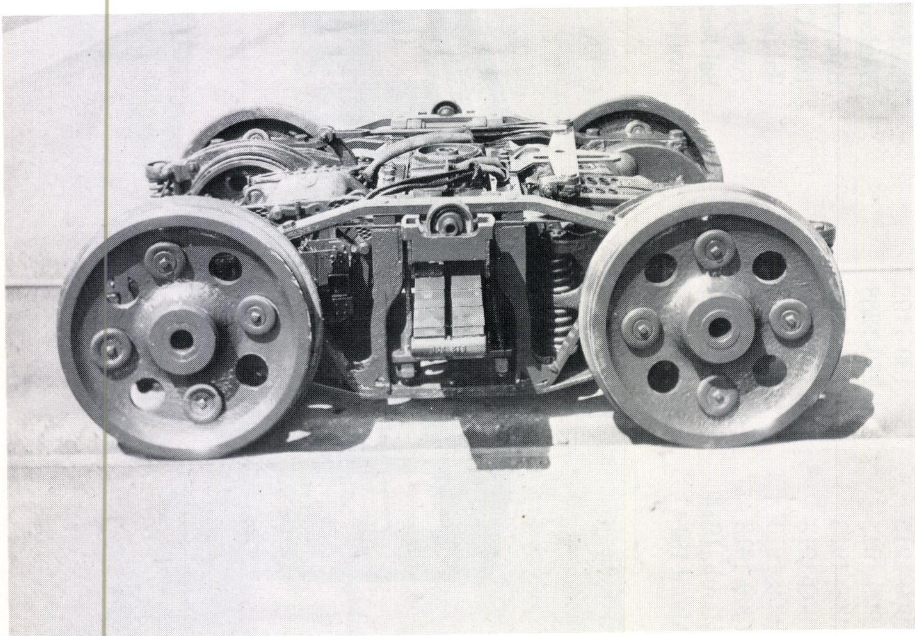
AVERY
PV119ED



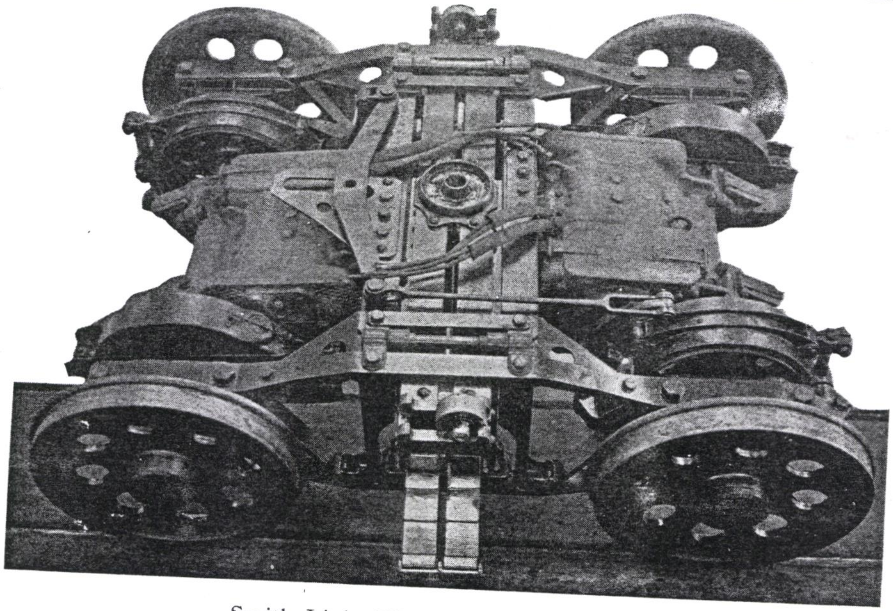
TC10 1916-17 FRICTION BEARINGS



Construction detail of the Twin City #12RB truck, showing the air-operated band brakes. (TCRT)



Twin City #12RB truck. (TCRT)



Smith Light Weight Noiseless Truck.

The Most Modern Development of Light Weight Truck for Electric Railways.

Large Saving in Power Consumption, Wheel Mileage, Brake Shoes and Car Service Labor for brake adjustment and inspection.

Only one brake adjustment in over 15,000 miles operation in Grand Rapids.

Constructed of heat treated steel and machined interchangeable parts.

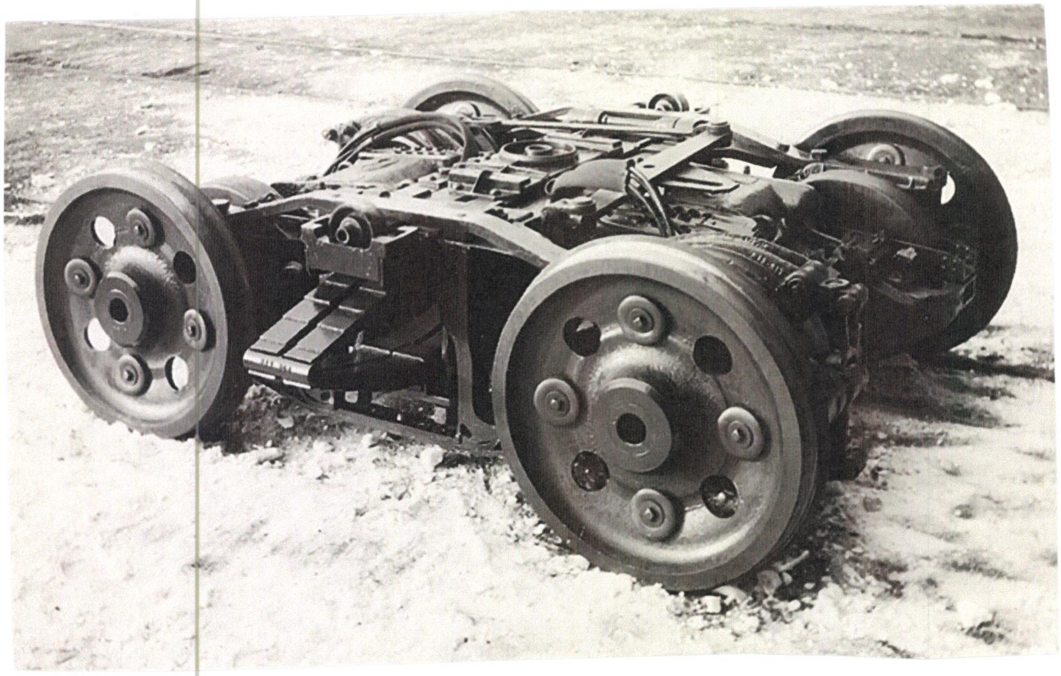
Equipped with Hyatt Roller Bearings in Inside Journal Boxes which afford support for the Automotive Type of Concentric Clasp Axle Drum Brakes. These brakes insure the most positive and comfortable braking, with elimination of the old style brake shoes and resulting noise and inspection.

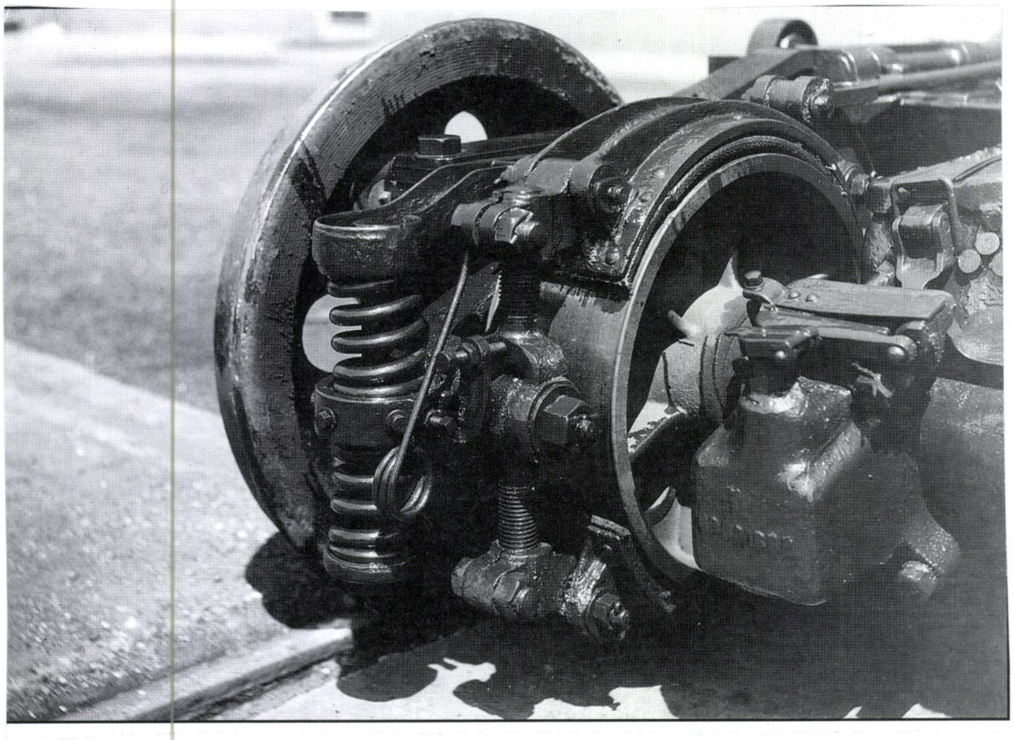
Easy Riding qualities accomplished by an exceptionally well balanced and graduated spring system, with two full elliptical springs and double set of spiral springs with a swinging spring plank, insuring proper spring support at all loads, allowing the bolster and car body to swing freely without jar or vibration in rounding curves—making a most easy riding coach.

Wheels are 26″ rolled steel, oil tempered, drilled with eight 3½″ holes in the web of each wheel, with noise subduers consisting of special rubber disks bolted in alternate holes in web. Hollow heat treated steel axles provide greatest strength with minimum weight.

1925

PV119ED
AVERY™





TC *10 TRUCK

W. J. SMITH.
TRUCK.
APPLICATION FILED MAY 8, 1920.

1,405,168. **Patented Jan. 31, 1922.**

2 SHEETS—SHEET 1.

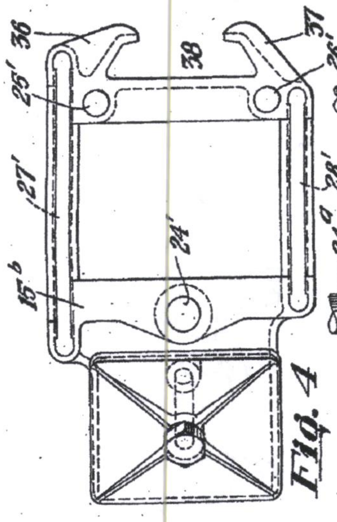

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Fig. 4

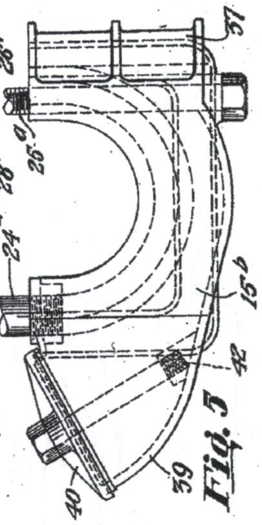
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Fig. 5

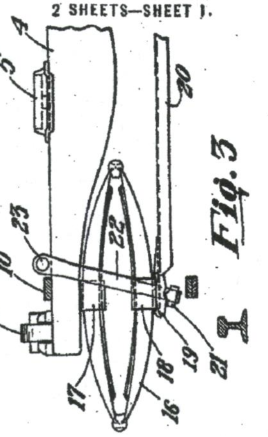
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Fig. 3

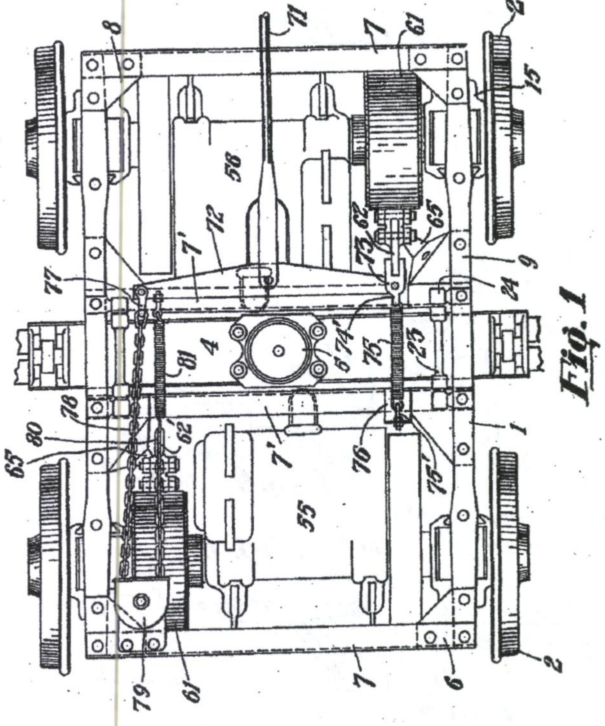
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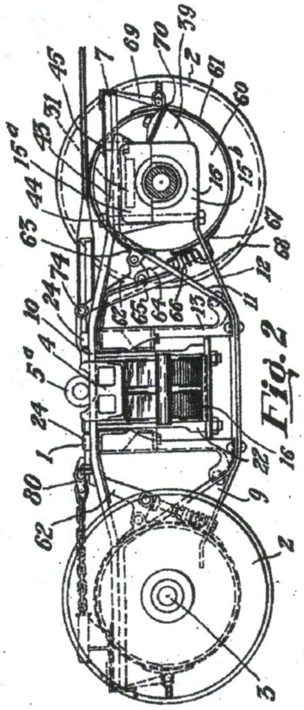
Fig. 1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3

Fig. 2

INVENTOR
W. J. Smith.
BY
Dull, Warfield & Dull
ATTORNEY

and aligned dovetailed recesses in said sections.

21. In a journal box for railway trucks, in combination, upper and lower sections divided substantially on horizontal lines, means for securing said sections in cooperative relationship, said means including a bolt passing downwardly in said upper section and threaded into said lower section, and a bolt passing upwardly in said lower section and threaded into said upper section, and dustguard recesses and aligned dovetailed recesses in said sections.

22. A journal box comprising, in combination, complementary journal box sections adapted to be secured in cooperative relationship, dustguard recesses at both ends of said journal box, and aligned recesses in said sections for securing said journal box to a truck.

23. A journal box comprising, in combination, complementary journal box sections adapted to be secured in cooperative relationship, and a dovetailed recess for connecting the journal box to a truck frame.

24. A journal box comprising, in combination, complementary journal box sections adapted to be secured in cooperative relationship, a grease pocket located at one side of said journal box, and aligned recesses in said sections opposite said grease pocket for securing said journal box to a truck.

25. A journal box comprising, in combination, complementary journal box sections adapted to be secured in cooperative relationship dustguard recesses at both ends of said journal box and a dovetailed recess for connecting the journal box to a truck frame.

26. A journal box comprising, in combination, complementary journal box sections adapted to be secured in cooperative relationship, dustguard recesses at both ends of said journal box, a grease pocket located at one side of said journal box, and aligned recesses in said sections opposite said grease pocket for securing said journal box to a truck.

In testimony whereof I affix my signature, in the presence of two witnesses.

WILLIAM JUDSON SMITH.

Witnesses:
M. F. Ernst,
E. N. Holstrom.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,405,168, granted January 31, 1922, upon the application of William Judson Smith, of St. Paul, Minnesota, for an improvement in "Trucks," errors appear in the printed specification requiring correction as follows: Page 3, line 7, strike out the words "secured at its upper end to a depending" and insert the words *provided on the horizontal portion and;* page 4, line 126, claim 6, for the words "side trussed" read *trussed side;* page 5, line 115, claim 19, before the word "upper" insert the word *said;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of March, A. D., 1922.

[SEAL.]

WM. A. KINNAN,
Acting Commissioner of Patents.

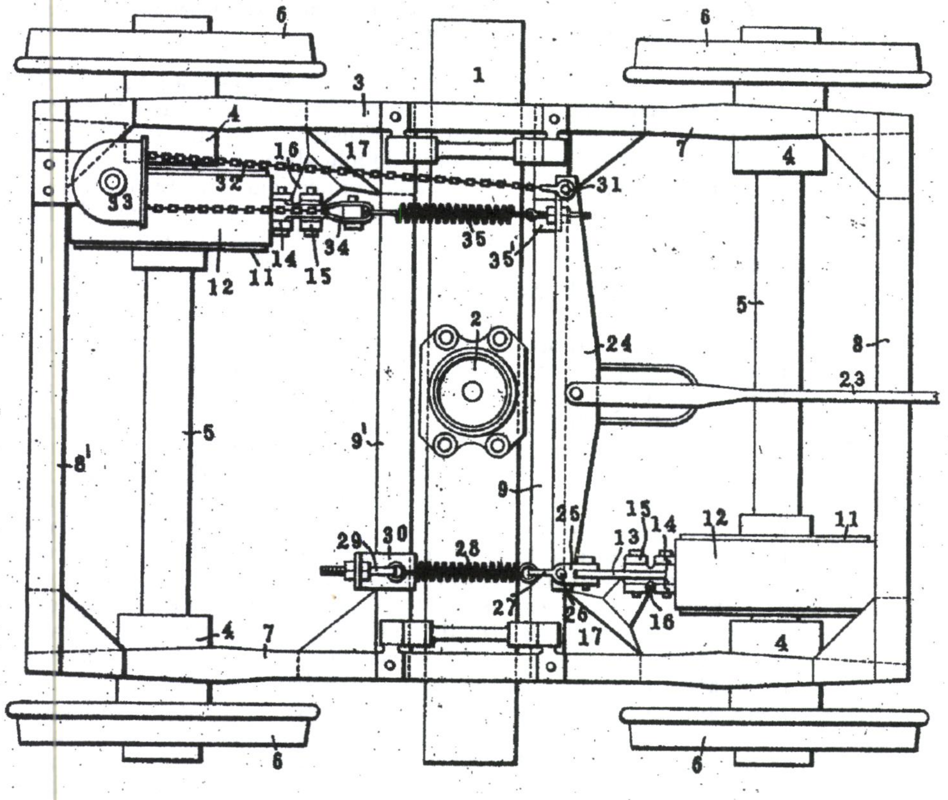
Feb. 17. 1925. 1,526,764

W. J. SMITH

RAILWAY BRAKE

Original Filed May 8, 1920

Fig.1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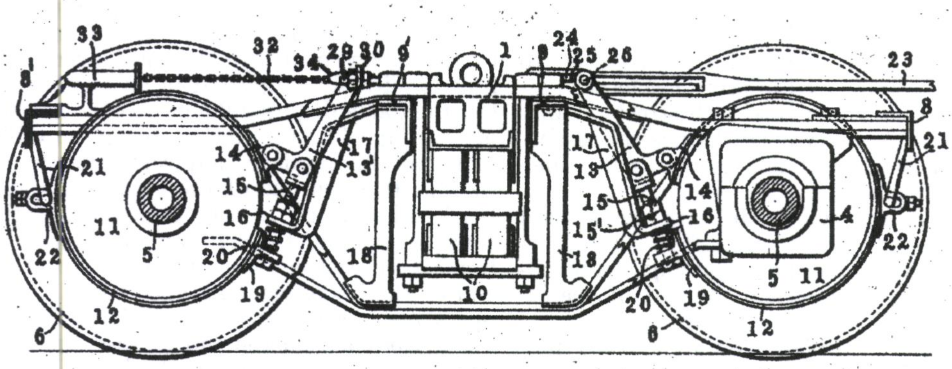
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Fig.2

INVENTOR

William J. Smith

BY

Drull, Warfield & Drull

ATTORNEY

trusses and carrying flanged wheels disposed outside of said trusses, of brake drums on said axles disposed inside of said truss frames, a brake band for each of said brake drums, an equalizing bar, a lever connected to one end of each of said brake bands and to each end of said equalizing bar, a link connected to each of said levers and to the opposite end of the corresponding brake band, and brackets carried by said truck frame and adjustably supporting said links.

4. In a railway truck, the combination with a truck frame having side trusses, transverse axles each extending at opposite sides of the truck frame beyond the said trusses and carrying flanged wheels disposed outside of said trusses, of brake drums on said axles disposed inside of said truss frames, a brake band for each of said brake drums, an equalizing bar connected at one end to one of said brake bands, a sheave, a flexible connection extending around said sheave and being connected with the opposite end of said equalizing bar and with another of said brake bands.

5. In a railway truck, the combination with a truck frame having side trusses, transverse axles each journaled in and extending at opposite sides of the truck frame and carrying flanged wheels, brake drums on said axles, an equalizing bar, friction means adapted substantially to encircle said brake drums, actuating levers operatively connected to draw said friction means into engagement with said brake drums, said levers having actuating connections leading to said equalizing bar, and brackets carried by said truck frame and adapted to support said levers and friction means in operative relation to said brake drums.

In testimony whereof I affix my signature, in the presence of two witnesses.

WILLIAM JUDSON SMITH.

Witnesses:
E. N. LEAF,
C. S. THOMSON.

TRACTION MOTORS

TRACTION MOTORS

Horsepower and Gear Ratios

Manufacturer	Model Number	H.P. Each	Passenger Gear Ratio	Service Gear Ratio	Comments
Thomson-Houston	W.P. 50	25	17:64	17:64	
General Electric	57	50	28:57	28:57	Note 1
			16:69		Note 2
" "	67	38	15:69	15:69	
" "	70	40	15:71	15:71	Note 3
" "	87	60	?		Note 4
" "	73	75	24:51	17:73	
			21:54		Note 5
" "	216	50	17:69	17:69	
" "	213	50	15:71		
" "	203	50	16:68		
" "	200	40	15:66		Note 6
" "	258	25	15:72		Note 7
			[redacted]		[redacted]
			14:73		Note 8
" "	264	24	?		
" "	275	60		15:57	Crane Car 83 only

Note 1 The Motor Specification Diagram dated 11-16-1894 mentioned in the chapter on Early Electric Equipment was updated as additional motors were purchased. The last entry on the diagram was for G.E. 57 motors acquired 12-27-1898. [redacted] The gear ratio of 28:57 gave the cars a top speed of 44 m.p.h.

Note 2 The gear ratio of 16:69 was used on cars 773-781 slowed down for city service after their replacement by high-speed suburban cars on the Stillwater Division.

Note 3 This equipment was geared for 26 m.p.h.

Note 4 Some cars with this equipment were assigned to the "Selby-Lake" line were they were geared for 35 m.p.h.

Note 5 24:51 ratio was used on the Lake Minnetonka Division cars while 21:54 ratio was used on the Stillwater Division cars as that line had more hills.

Note 6 This type of equipment gave a top speed of 37 m.p.h. When field control was installed at the time of rebuilding to one/two man operation the top speed increased to 42 m.p.h.

Note 7 Cars 2000-2003 and 1-4.

Note 8 Cars 2004-2030.

GENERAL ELECTRIC MOTORS								
Motor	H.P.	Weight with gear and case	Maximum Diameter of Axle	Sum of Gear and Pinion	Gear Ratiio Standard	Gear Ratio Minimum	Gear Ratio Maximum	Equipment Weight Four Motors
67	40	2425	4 1/4	84	17 to 67	15 to 69	24 to 64	11000
57	50	3002	4 1/2	85	19 to 66	18 to 67	26 to 59	14200
70	40	2785	5 1/2	86	17 to 69			
					19 to 67	15 to 71	22 to 64	12530
87	60	3430	5 1/2	87	16 to 71			
					18 to 69	16 to 71	23 to 64	16290
					20 to 67			
73	75	4147	6	75	17 to 58			
					19 to 56	17 to 58	24 to 51	19382
					21 to 54			
200	40	2120						9880
203	50	2600						12100
216	50	2875						13200

MOTORS							
ERH 1924							
Mfg. No.	H.P.	RPM	Weight Motor alone	Weight wih Gear and Case	Maximum Gear Ratio	Comm. Poles	Form of Frame
57-A	50	575	2896	3301	16 to 69	No	Split
67-A	40	518	2075	2445	15 to 69	No	Split
70-A	40	502	2400	2850	15 to 71	No	Split
73-C	75	520	3630	4070	17 to 73	No	Box
87-A	60	500	2940	3380	16 to 71	No	Split
200-K	40	745	1800	2160	14 to 67	Yes	Split
203-P	50	760	1865	2200	15 to 83	Yes	Box
216-A	50	635	2390	2830	15 to 71	Yes	Box
258-C	25	1236	746	896	13 to 74	Yes	Box

OCTOBER 1897

The G. E. 57 Railway Motor.

In line with the G. E. 52 and G. E. 1000 railway motors, the General Electric Company announces a third, the G. E. 57. This is called forth by the success and popularity of the G. E. 1000, to which it is similar in design, but of greater capacity, while still as compact and simple. It is intended for heavy city and suburban work and is suitable for service of that class e ther as a two or four motor equipment.

The G. E. 57 has an output of 50 h. p. at 500 volts, rated according to standard General Electric basis a maximum rise of 75 degs. C. in the temperature of the windings after a run of one hour at rated load, the temperature of the surrounding air not exceeding 25 degs. C.

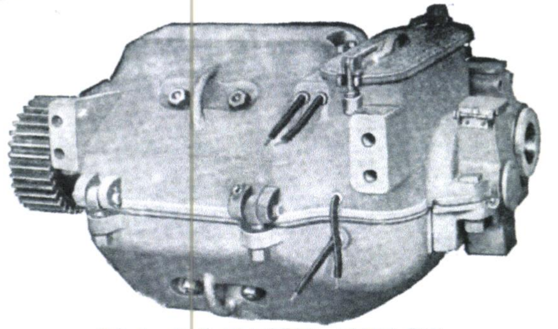

FIG. 1.—G. E. 57 MOTOR—FRONT END.

The frame is of similar construction to that of the G. E. 52 motor. It is of steel, cast in two bowl-shaped pieces, with a hand hole in the lower half directly beneath the commutator. This permits free access to the bottom of the motor for inspection or cleaning. The frame is both water and dustproof, the cover plate at the top half being provided with a felt gasket and clamping bolts as in the G. E. 1000 motor. The motor has four laminated poles, each having a separate coil held in place by the pole piece, which is bolted to the frame, the bolts projecting through the frame with nut and lock washer on the outside.

Knowing the amount of trouble that has been experienced by street railway companies from small motor bearings and their poor lubrication, the bearings of this motor have been designed with special reference to these points. The armature bearings are of the following dimensions: pinion end, 3¼ ins. × 8¾ ins.; commutator end, 2⅞ ins. × 6⅜ ins. They are designed and built on the "outboard" plan. The support for the upper half of the lining is cast as a part of the upper half of the frame, and between the inner end of the outboard bearing and the motor frame there is a large cored recess. This space is utilized for a combination thrust collar and oil guard, which is funnel shaped and extends through the motor frame into the cored recess, where it acts as an oil guard, 8 ins. in diameter. The support for the lower half of the lining is a cap bolted to the upper half, but not enclosing the lower half of the oil guard. This allows free egress to the lubricant after it has passed through the bearing and makes it impossible for it to work through into the motor frame. Either oil or grease may be used in the bearings. The lower boxes, or oil wells, are fitted with felt wicks, which wipe the shaft through holes cut in the linings. For the armature bearings, there are two of these wicks on the pinion end and one on the commutator end. For each of the axle bearings there are two wicks.

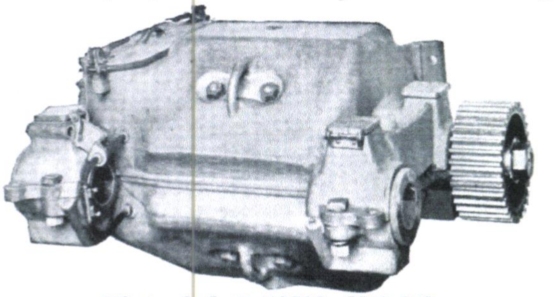

FIG. 2.—G. E. 57 MOTOR—REAR END.

The field coils are wound on cast spools thoroughly insulated with asbestos, mica and paper, and wound with copper ribbon insulated with asbestos. A covering of heavy duck, drawn together and sewed after the spool has been wound, forms a perfect mechanical protection for the winding. As in the G. E. 1000 motor, the upper and lower field connection is made on the outside of the motor, and all leads to the car are brought out on the front end. This has been found convenient in the car wiring and opening of the motors.

The armature is similar in construction to the G. E. 52 armature. It is small and compact, being 14 ins. in diameter, with a spread of 12 ins., and has thirty-three slots. It is ironclad, the core being built up of well annealed laminated disks, assembled directly on the armature shaft. In assembling the core, three sets of spacing blocks are used, providing three ventilating ducts. This form of construction is similar to that of the G. E. large generator armatures. There are thirty-three triple coils; each coil composed of three separate coils bound into a compact single unit. The separate coils are wound with either two or three turns per coil, as may be specified, the three turn winding being standard for ordinary service.

This method of winding is a distinct advantage in the matter of armature repairs, there being comparatively few coils to look after, while the construction admits of a substantial insulation of high quality, insuring immunity from repairs. A special effort has been made in the design of this motor to have the armature as light as possible without detracting from its electrical merit and efficiency, a light armature having small inertia presenting special advantages in starting and braking.

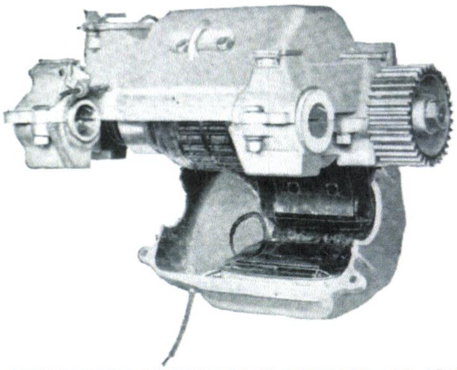

FIG. 3.—MOTOR WITH LOWER FRAME DROPPED AND ARMATURE IN POSITION.

The standard gear ratio is 3.72, with a taper bore pinion having eighteen teeth, and a cast steel gear having sixty-seven teeth, and a face of 5 ins. A two motor equipment with this ratio will propel an 18 ton car about 26 miles per hour on level track. For heavy haulage work a lower speed gear ratio may be used, giving a slower speed and correspondingly increased tractive effort. A higher speed gear ratio may also be used, giving an increased speed and correspondingly decreased tractive effort.

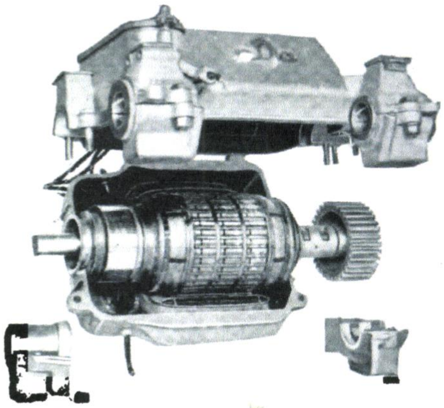

FIG. 4.—MOTOR WITH ARMATURE READY FOR REMOVAL.

The commutator is similar in construction to the G. E. 1000 and has ninety-nine segments. The segments are of hard drawn copper 2 ins. deep, allowing a wearing depth of 1 in. The brush holders are staggered to prevent the wearing of ridges in the commutator, and each holder contains two radial brushes 2¼ ins. long × 1¾ ins. wide × ⅜ in. thick.

The standard G. E. 57 motor is adapted to either the nose or the yoke suspension as in the G. E. 1000 or the G. E. 52 motor. The motor can be fitted for side bar suspension, but this necessitates a slight modification of the frame. The yoke suspension is recommended, as with this suspension the weight of the motor is carried on springs placed on the side frames of the car trucks. Lugs are cast on the upper half of the motor frame, to which the suspension bar is bolted. For inspection or repairs the lower half of the motor can be swung down into the pit without disturbing the upper half. When the motor is mounted on 33 in. wheels the clearance between the bottom of the motor and the top of the track rail is 3¼ ins. The clearance between the bottom of the gear case for 67 tooth axle gear and the top of the track rail is 4⅛ ins.

The G. E. 57 motor without gear or gear case weighs 2632 lbs. With 67 tooth gear and gear case the weight of the motor complete is 2972 lbs.

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G. E. 67 Motor.—Rated horse-power 38. Speed at full load, 525 rev. Reduction ratio, 3.94. Gear, 17 teeth on pinion. 67 teeth on gear; 4 poles; 4 field coils; 110.5 turns, total of 4 coils. Armature has 37 slots, 18 conductors per slot; number of bands, 6. Commutator bars, 111. Armature bearings: commutator bearing, 2⅝ ins. x 6⅛ ins.; pinion bearing, 3 ins. x 8 ins. Weight, 575 lbs. Diameter, 14⅛ ins.; length, 8⅛ ins. BUILT 1899 REPLACED GE 800 MOTOR

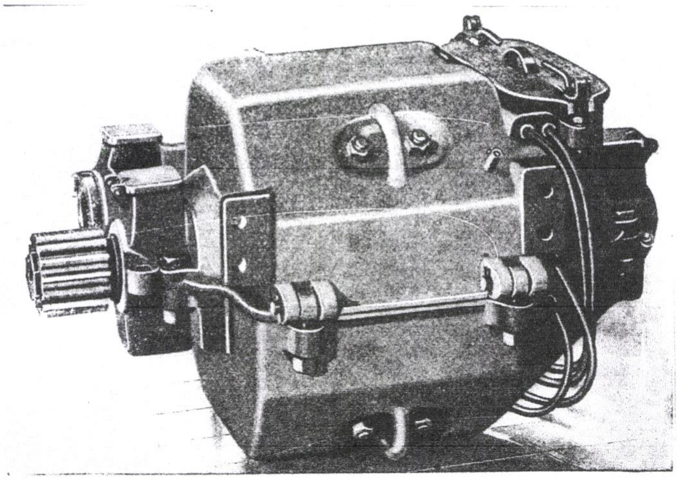
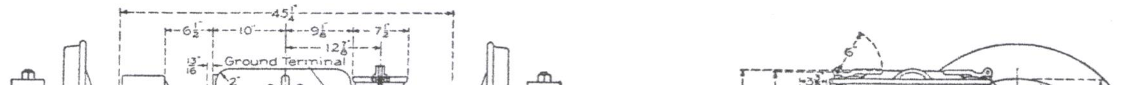


FIG. 4774. G. E.—67 RAILWAY MOTOR, 40-H.P., FOR CITY AND LIGHT SUBURBAN SERVICE. FRONT VIEW, CLOSED.


Ground Terminal
Center of Axle
Cen. of Armature and Truck
Bolts 1" x 3⅜"
33"
13.986"
747

FIGS. 4778-4781. RAILWAY MOTOR SUSPENSION. YOKE FORM OF SUSPENSION AS APPLIED TO G. E.—67 MOTOR.

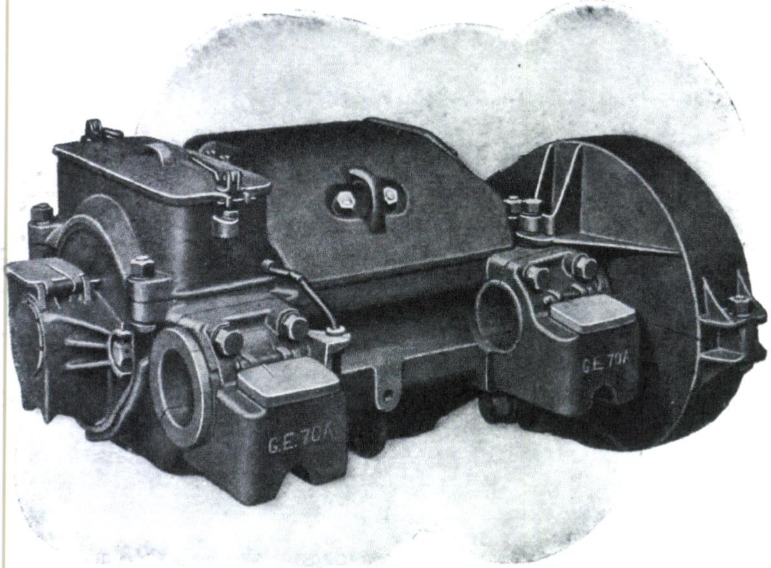
General Electric Company

GE-70 Motor

For City and Suburban Service

Economical of Space

Superior Method of Lubrication



Convenient to Handle

Improved Gear Cover Support

GE-70 RAILWAY MOTOR, 40 H. P.

That 2616 of these recently developed motors have been sold is proof of their merit

Principal Offices: Schenectady, N. Y., U. S. A.

New York Office, 44 Broad Street **Sales Offices in all Large Cities in U. S.**

FOR GREAT BRITAIN AND IRELAND:

The British Thomson-Houston Co., Ltd., Rugby, and 83 Cannon Street, London, E.C.

G. E. 73 Motor.—Rated horse-power, 75. Speed at full load, 485 rev. Reduction ratio, 4.23. Gear, 17 teeth on pinion, 72 teeth on gear; 4 poles; 2 field coils 80 turns, 2 field coils 40 turns. Armature has 39 slots, 12 conductors per slot. Commutator bars 117. Armature bearings: commutator bearing, 3⅛ ins. x 7$\frac{11}{16}$ ins.; pinion bearing 3½ ins. x 10 ins. Weight of armature, 1,150 lbs. Diameter of armature 18 ins.; length, 10¼ ins.

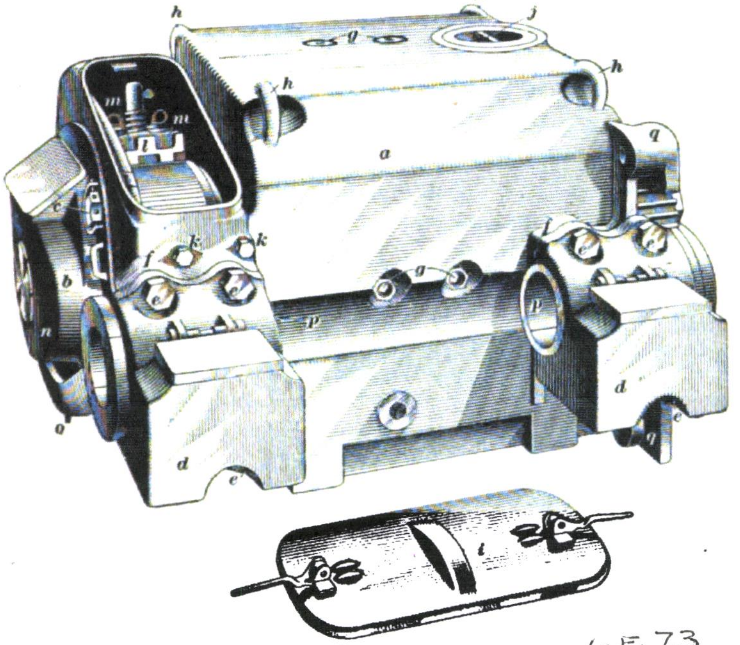


Fig. 23

G.E. 73

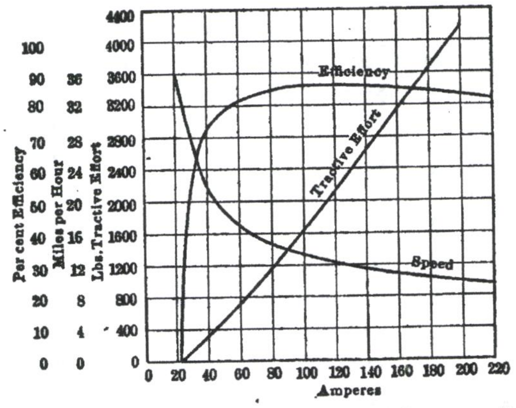


Fig. 10.—General Electric No. 73 railway motor. 75 h.p., 500 volts, pinion 17, gear 73, ratio 4.30, wheels 33 in.

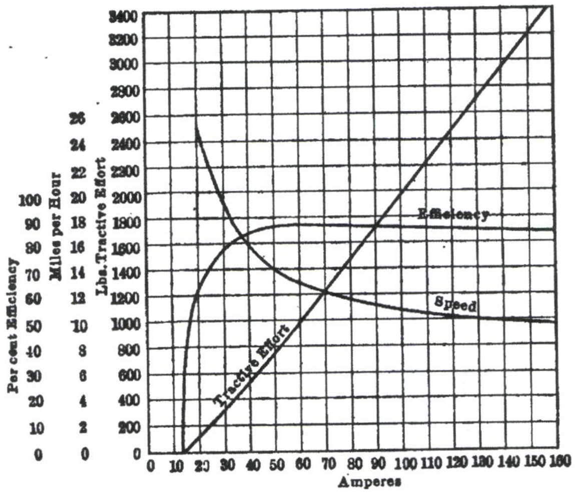


Fig. 9.—General Electric No. 87 railway motor. 60 h.p., 500 volts, pinion 16, gear 71, ratio 4.44, wheels 33 in.

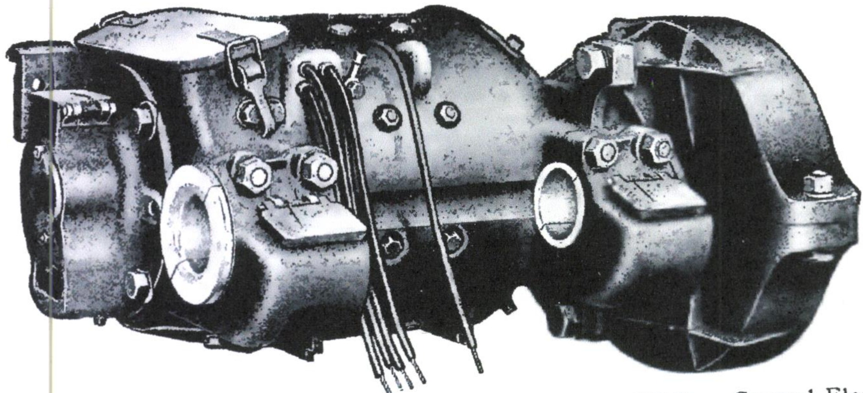


Fig. 2562—G. E.-216A, 50 H. P., 600 Volt Railway Motor. Weight, 2,875 lbs. General Electric Company.

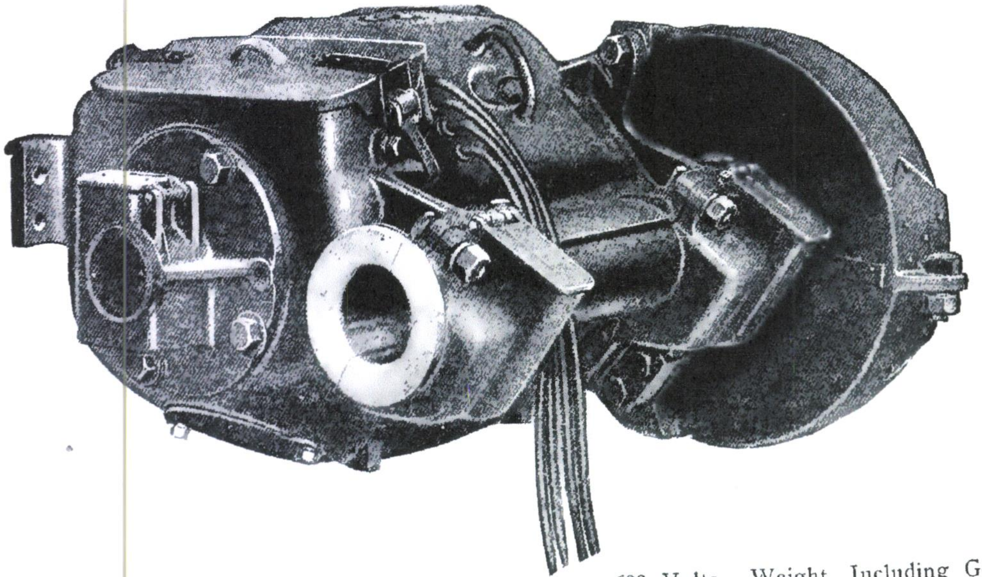
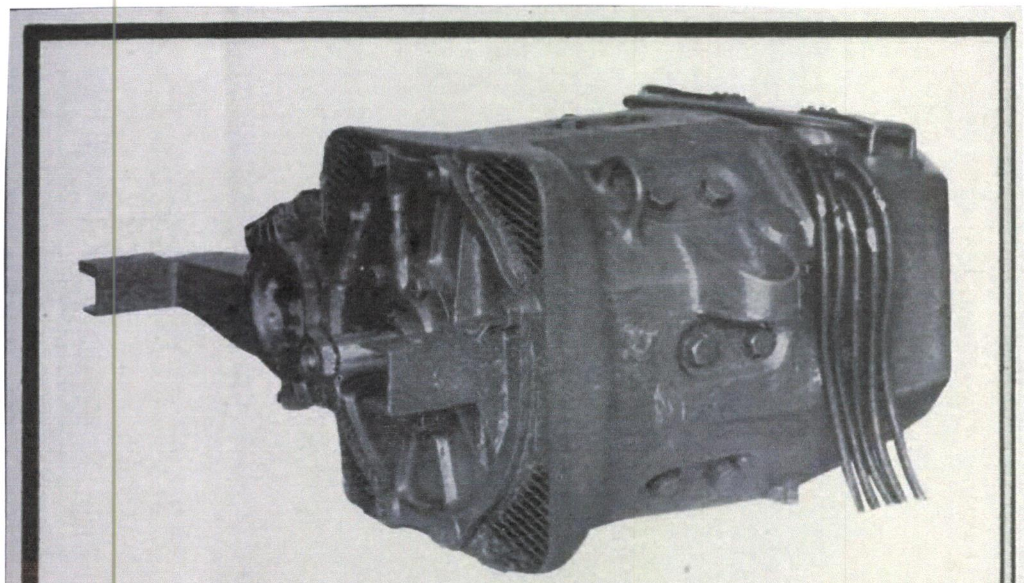


Fig. 2565—G. E. 203A Railway Motor. Capacity 50 H. P. at 600 Volts. Weight, Including Gear and Case, 2,150 lbs.
General Electric Company.



The G-E 258 (25 HP.) Railway Motor

CONTROLLERS						
ERH 1915						
		Number	Total HP	Number	of Points	Weight
Controller		of Motors	500 Volts	Series	Parallel	Lbs
K-6-A		2 or 4	160	6	5	270
K-11-A		2	120	5	4	225
K-14-A		4	240	7	6	550
K-28-B		4	160	5	3	239
K-35-G		2 or 4	200	5	3	267

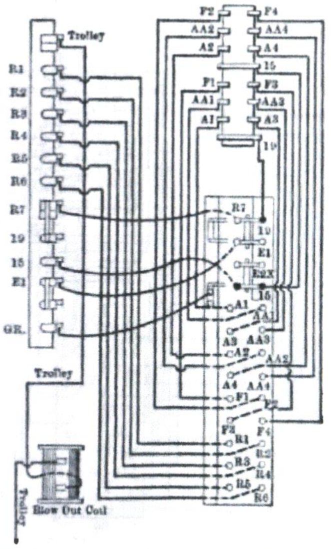

Trolley
R1
R2
R3
R4
R5
R6
R7
19
15
E1
GR.
Trolley
Blow Out Coil
Trolley
F2
F4
AA2
AA4
A2
A4
F1
F3
AA1
AA3
A1
A3
E2X
R1
R2
R3
R4
R5
R6

FIG. 3.—Wiring diagram, K-6 controller.

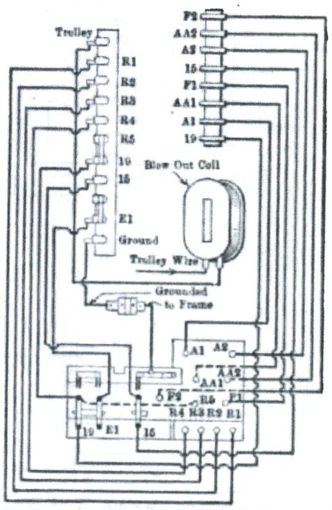

Trolley
R1
R2
R3
R4
R5
19
15
E1
Ground
Blow Out Coil
Trolley Wire
Grounded to Frame
F2
AA2
A2
15
F1
AA1
A1
19
A1
A2
AA1
AA2
R4
R3
R2
R1
R5
19
E1
15

FIG. 4.—Wiring diagram, K-11 controller.

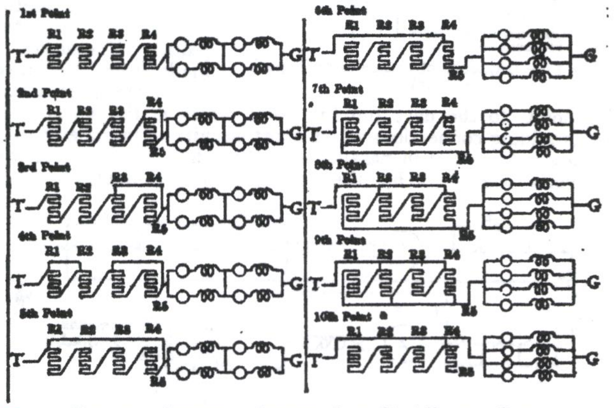

1st Point
2nd Point
3rd Point
4th Point
5th Point
6th Point
7th Point
8th Point
9th Point
10th Point
R1
R2
R3
R4
R5
T
G

FIG. 10.—Sequence of connections, K-28-B controller.

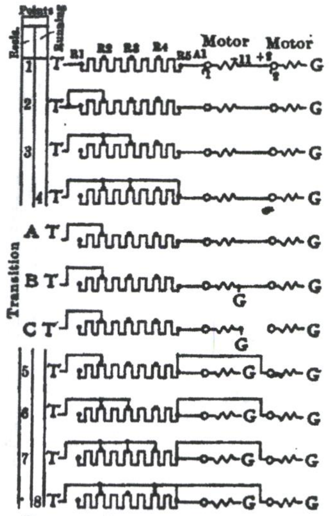

Points
Resis.
Running
R1
R2
R3
R4
R5
A1
Motor
Motor
T
G
1
2
3
4
A
B
C
Transition
5
6
7
8

FIG. 2.—Sequence of connections type *K* controller, shunted motor transition.

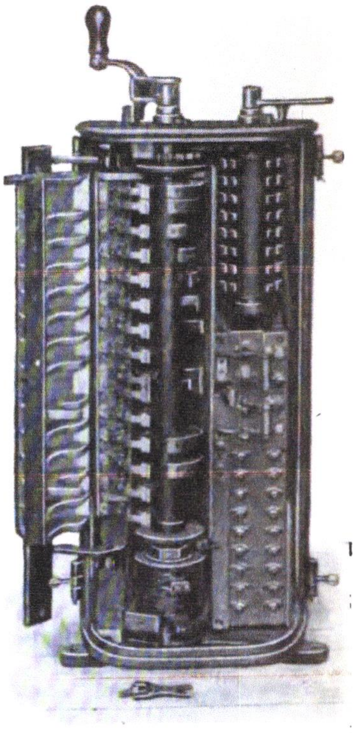


FIG. 4824.
K-6 SERIES PARALLEL CONTROLLER.
GENERAL ELECTRIC COMPANY.

THE K14 CONTROLLER

38. The K14 controller is designed for the control of four 60-horsepower motors; it has seven series-notches and six parallel notches, *7* and *13* being the two running notches. Since this controller has to carry quite a large current, its construction differs somewhat from the K controllers already described. Fig. 13 is a general view of the controller with the cover removed and the pole piece swung back. The main cylinder *a* is driven through gears *b*, *c* by the operating handle *d*, the angle turned through by the drum being greater than the angle through which the operating handle is turned from the on- to the off-position. The main cylinder rotates in a direction opposite to that on ordinary controllers; hence, the contact fingers are placed to the right of the cylinder. The reverse cylinder is at *e* and is operated by handle *f*; cylinders *e* and *a* are interlocked, and handle *f* cannot be removed until both cylinders have been turned to the off-position. The trolley connection with the main cylinder is made at *g*, at the bottom of the cylinder. Instead of using a regular contact

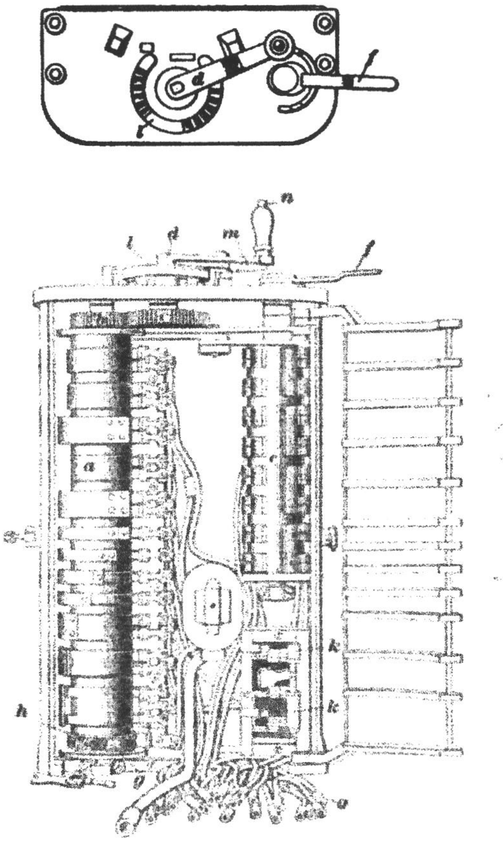


FIG. 13

finger at *g*, contact is made with the cylinder by means of a split casting passing completely around a collar. This casting can be adjusted by nut *h*, so as to make a good contact without interfering with the movement of the cylinder, and it affords a better contact surface for the larger current than would be provided by a contact finger. The cut-out switches are located at *k*, *k* and are arranged in connection with an interlock to prevent the drum from being moved to the parallel position when either motor is cut out. This controller has no index wheel, but the notches are located by a hinged lever *m*, under the operating handle, that drops into notches in an index *l* mounted on top of the controller. Lever *m* is raised so as to clear the notches by the motorman pressing down on knob *n* on top of the operating handle. The controller has no connection board, the terminal wires being brought out of the bottom of the controller and fastened to the car wires by means of clamp terminals that are thoroughly taped over after the connections have been made.

ERJ JUNE 1926

Improvements Made in Car Equipment Apparatus*

By C. J. Axtell

Special Railway Engineer
General Electric Company

CAR equipment apparatus is a comprehensive subject, and the most interesting phase is that dealing with recent improvements. Changes made in the K-35 controller are typical of the improvements in other controllers of this class. The back casting has been changed to include a vertical trough up the back on each side to provide sufficient room to install the largest size of motor cables. This shortens the time necessary to change a controller. The cable terminals are a flat flag type in which the cables are permanently soldered, and fastened to the finger bases by a cap screw.

Contacts of the cutout switch have been reinforced by heavy flat springs, increasing the capacity of the switch and eliminating troubles due to poor contact and overheated switches. Where the insulated hexagonal shaft is used, the insulation is molded on. It is now molded in hexagonal tubes which accurately fit the standard shaft and can be easily renewed, by dismounting the cylinder castings and replacing the damaged insulation with a new piece. Reverse fingers, having a flat phosphor bronze spring and a heavy copper contact tip, insure decreased burning at the segments.

All modern K controllers with individual finger blowouts are now provided with arc suppressor plates inserted in the arc chute between the deflectors. This plate consists of a specially molded part of arc resisting compound which partially closes up the arcing space and directs the arc through two narrow slots. The older lock type burning tips are replaced with a lap type or one in which the segment screw passes through a hole in both the segment and the burning tip so that it cannot loosen up and drop off the segment as might be possible with the old style.

Cap plates are now made with provision for mounting the LB control device without any machining operations. K-35 controllers furnished with cast aluminum alloy back and cap plates reduce the weight of the controller 19 per cent.

A new type of line breaker known as the DB-986 and DB-987, consisting of a very efficient arc rupturing contactor, magnetically operated and an overload relay inclosed in a box for under car mounting has been developed. This operates to break the motor circuit when normally turning off the controller as well as rupturing overloads and short circuits.

Among the recent improvements is the arrangement for removing the complete arc chute without the use of tools, simply by raising it up to unhook the top and withdrawing the chute, when the entire mechanism and the contact tips are exposed for inspection. The overload relay also has the novel feature of not only opening up the control circuit of the contactor, but also of mechanically opening the contact tips.

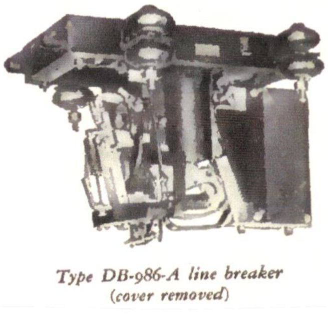
The early use of the line breaker provided for the breaking of the arc when the controller was turned to the off position. The ratchet switch improved this operation by requiring that the controller be turned backward but one step in order to open the line breaker. However, to improve further this operation the line breaker control device was developed. It is mounted on top of the cap plate. This permits the addition of this handle to any of the recently manufactured controllers, without the necessity of taking out the cylinder, changing the bearings or mounting any apparatus on the shaft. This breaker has the great advantage of opening up the control circuit of the line breaker on a slight backward movement of the controller handle and before the main cylinder has started to turn off.

With the advent of the new light-weight car, a new controller was needed which controller should be small, light weight and low in height. The K-75 controller was designed to fulfil this need. It has a capacity for operating four 50-hp., 600-volt motors. The contact tip is renewable by removing one cap screw. The arc chute is hinged to swing to the right instead of to the left, thus exposing for inspection all the fingers, blow-out coils and main cable connections when the arc chute is opened. Resistors used are in four sections, assembled in one group instead of with two groups as with the K-35 controller. The controller has five points in series and three points in parallel. A single motor cutout switch provides for cutting out two of the motors and permits operating the remaining pair in series-parallel relation instead of in series only.

The US-20-A trolley base, like its predecessor the US-13, has four tension springs adjusted by a single screw and provides for fastening the pole by means of a clamp held by two bolts. The bottom of the base is flat, eliminating the necessity of recessing any projection in the wood platform. Instead of a series of long small rollers, this base has two sets of short tapered rollers, set in accurately machined raceways which are provided with very liberal grease reservoirs. Two pipe plugs afford easy means of filling oil to taper roller bearings and to pole socket axle pin reservoirs. A trigger lock can be actuated to secure the trolley poles socket in a lowered position for changing poles.

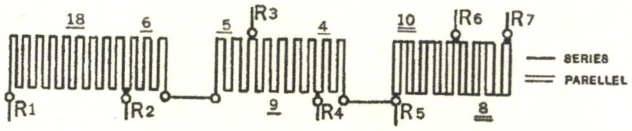
Type K-75 control with LB handle

Type K-75 control with LB control handle is designed for light-weight cars. Although smaller and lighter than standard controllers, it embodies the latest improvements including hinged-type control fingers. The LB handle, which provides for opening and closing of the control contacts before the drum is moved, confines practically all arcing to the line breaker; all heavy currents are opened under the car.



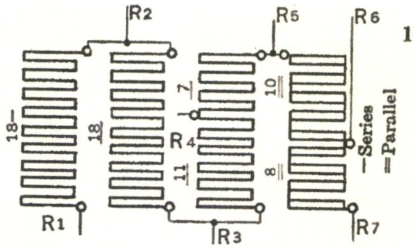
Type DB-986-A line breaker (cover removed)

G-E line-breaker equipment not only prevents a large percentage of the arcing that would otherwise occur in the controller, but it also protects the equipment from short circuits and overloads above a predetermined value. A substantial reduction in maintenance costs is thus made possible.


18
6
5
R3
4
10
R6
R7
SERIES
PARELLEL
R1
R2
9
R4
R5
8

11 – A – 24 + 8 – A – 18 + 9 – B – 18 = 60 grids
R_1 to R_2, 18 grids of 26,511 = 1.66 ohms
R_2 to R_3, 6 grids of 11 + 5 of 08 = 0.84 ohms
R_3 to R_4, 9 grids of 08 = 0.53 ohms
R_4 to R_5, 4 grids of 08 = 0.24 ohms
R_5 to R_6, 10 grids of 09 = 0.18 ohms
R_6 to R_7, 8 grids of 09 = 0.15 ohms

FIG. 101.—GE car resistance connections for four GE-67 or 80 C motors and K-6 controller


R2
R5
R6
18–
18
7
R4
11
10
8
–Series
=Parallel
R1
R3
R7

10 – A – 18, 7 – A – 18, 6 – A – 18, 8 – B – 18 = 72 grids total
R_1 to R_2, 18 grids of 26,510 = 1.60 ohms
R_2 to R_3, 18 grids of 26,507 = 0.85 ohms
R_3 to R_4, 11 grids of 26,506 = 0.42 ohms
R_4 to R_3, 7 grids of 26,506 = 0.28 ohms
R_5 to R_6, 10 grids of 26,508 = 0.15 ohms
R_6 to R_7, 8 grids of 26,508 = 0.12 ohms

FIG. 95.—GE car resistance connections for four GE 57 (50 h.p.) motors and K-14 controllers

11 – A – 24 + 9 – A – 18 = 42 grids total
R_1 to R_2, 22 grids of 26,511 = 2.00 ohms
R_2 to R_3, 2 grids of 11 + 11 of 09 = 0.98 ohms
R_3 to R_4, 4 grids of 26,509 = 0.30 ohms
R_4 to R_5, 3 grids of 09 = 0.22 ohms

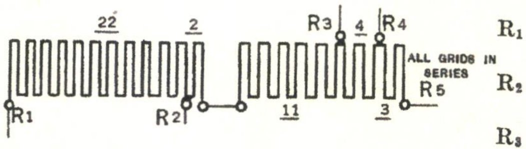

22
2
R3
4
R4
ALL GRIDS IN SERIES
R5
R1
R2
11
3

FIG. 96.—GE car resistance connections for two GE-57 (50 h.p.) motors and K-11 controllers

*RHEOSTATS FOR CAR EQUIPMENTS

TYPE CG

Controller	Motors	Standard Rheostat Equipment	Connection Diagram
K	2 GE-800	1 CG-14A24 1 CG-14A8-11A16 1 A-3 shunt	DS-3902
K-2	2 GE-800 2 GE-1200	1 CG-14A24 1 CG-14A6 -12A13-11A5 1 A-3 shunt	DS-3897
→ K-6	4 GE-67 4 GE-58 4t	1 CG-8A18 1 CG-9B18 1 CG-11A24	DS-1867
K-10	2 GE-800 2 GE-52 2 GE-54 2 GE-58 6t	1 CG-14A24 1 CG-12A11-11A13	DS-3163
K-10	2 GE-1000 2 GE-58 4t 2 GE-67	1 CG-13A24 1 CG-12A10-10A11	DS -2503
→ K-11	2 GE-57	1 CG-9A18 1 CG-11A24	DS-1871
K-12	4 GE-54 4 GE-58 6t 4 GE-60 4t	1 CG-9A18 1 CG-11A24	DS-1871
K-12	4 GE-800 4 GE-52 4 GE-60 6t	1 CG-12A24 1 CG-10A9-9A9	DS-2055
→ K-14	4 GE-57	1 CG-6A18 1 CG-7A18 1 CG-8B18 1 CG-10A18 or (depending on service conditions) 1 CG-10A12-6A6 1 CG-6A18 1 CG-4A12-7B6 1 CG-7B8-6B10	DS-1843 DS-3301
→ K-28	4 GE-70 4 GE-1000 4 GE-67 4 GE-58 4t	1 CG-9A13-10A5 1 CG-10A15-8A3 1 CG-8A18 or (depending on service conditions) 1 CG-8A18 1 CG-8A3-10A9-6A6 1 CG-6A18	DS-4270 DS-4520

*Rheostats suitable for car equipments other than those given in the table will be recommended on request. Such request should contain information as to the following: Gear ratio, horse-power and make of motors, diameter of car wheels and weight of car.

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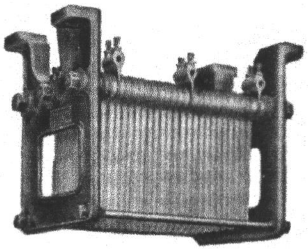
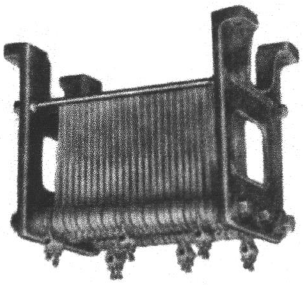
RHEOSTATS FOR CAR EQUIPMENTS

TYPE CG



Form A Frame



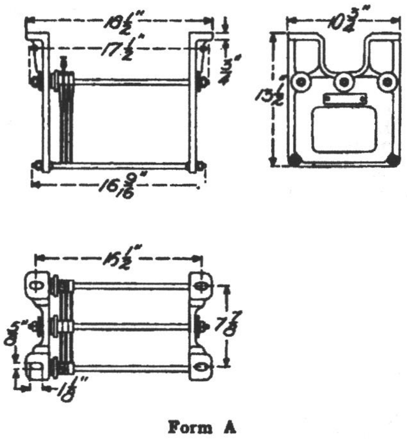
Form C Frame

TYPE CG RHEOSTATS—FORM A

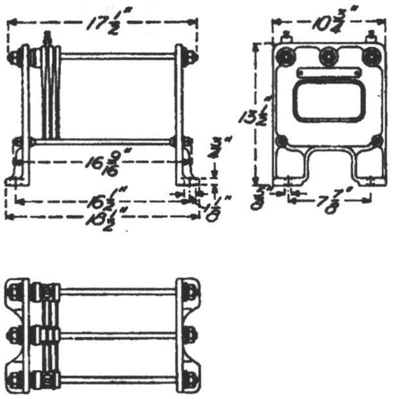
In the following list of rheostats will be found combinations suitable for practically all requirements.

4A18
4B18
4C18
5A18
5B18
5C18
6A18
6B18
7A18
7B18
7C18
8A18
8B18
9A18
9B18
10A18
11A24
11B24
12A24
13A24
14A24
4A12-7B6
7B8-6B10
7B10-6B8
9A13-10A5
10A9-9A9
10A12-6A6
10A13-11A6
10A15-8A3
10B16-7B2
11A9-9A11
11A12-8A9
11A19-9A3
11A20-14A4
12A10-10A11
12A11-11A13
14A8-10A12
14A8-11A16
8A3-10A9-6A6
8A7-6A5-7B6
12A3-10A9-8A6
12A6-12B8-11B10
12A8-11A8-8A6
14A6-12A13-11A5

DIMENSIONS



Form A



Form C

NOMENCLATURE

The following explanation of the nomenclature of the CG Rheostats, will permit of the exact determination from the rating of a rheostat, of the size or sizes of grids employed in its construction and all facts regarding connections, etc. A clear understanding of this nomenclature will be of considerable assistance in handling repair part business.

Each rheostat is designated by the type letters CG followed by a group or groups of symbols, the groups, where there are more than one, being separated by dashes. The symbols in each group consist of three parts, *viz:*

1st Part—A figure indicating the size of the grids in the group. The grids are numbered in serial order in sequence of their resistances, their serial numbers corresponding with their catalogue numbers.

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RHEOSTATS FOR CAR EQUIPMENTS

TYPE CG—(Concluded)

2nd Part—A letter indicating the way in which the grids are connected within the group, "A" indicating that the grids are connected in series, "B" indicating that two grids are connected in multiple, the pairs in series, "C" three grids in multiple. In each case the sets are connected in series.

3rd Part—A figure indicating the number of grids in the group.

Illustrating the above, CG-8A18 is a rheostat composed entirely of No. 8 grids connected in series and containing 18 grids.

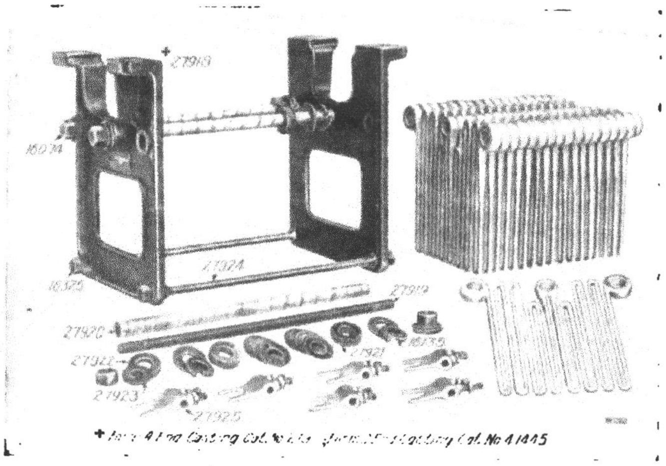
CG-8B18 is a rheostat composed entirely of No. 8 grids connected two in multiple and containing 18 grids. CG-8C18 indicates that the same grids are used, but that they are connected three in multiple.

CG-4A12-7B6 indicates that the rheostat contains 12 No. 4 grids connected in series and six No. 7 grids connected two in multiple and the groups connected in series.

Cat. Nos. are not assigned to complete CG rheostats as the number of possible resistance combinations is practically infinite and each rheostat is fully identified by its descriptive symbol.

TYPE CG RHEOSTAT GRIDS

Cat. No.	No. of Grids per Rheostat	Size No. of Grid	Resis. per Grid at 70° C.	AMPERES		Weights in Lb. per 100 Grids
				Continuous Cap. at 175° C. Rise	Intermit. Cap. on 10 Sec. off 20 Sec. at 250° C. Rise	
26504	18	4	.023	75	150	420
26505	18	5	.030	68	135	360
26506	18	6	.038	60	120	290
26507	18	7	.047	55	105	260
26508	18	8	.059	50	90	200
26509	18	9	.074	45	80	175
26510	18	10	.092	40	70	200
26511	24	11	.092	35	65	190
26512	24	12	.113	33	60	175
26513	24	13	.142	31.5	55	160
26514	24	14	.177	30	50	138



Parts of Type CG Rheostat

The Sprague-General Electric Type M Control System

The Sprague-General Electric Type M Control is designed primarily for the operation of a train of motor- and trail-cars, coupled in any combination, and the whole operated as a single unit from any controller on the train. The system may also be used to advantage on individual equipments and locomotives.

The control apparatus for each motor-car may be considered as consisting essentially of a motor controller and a master controller.

The motor controller comprises a set of apparatus—usually located underneath the car—which handles directly the power circuits for the motors, connecting them in series and parallel and commutating the starting resistance in series with them. This motor controller is operated electrically, and its operation in establishing the desired motor connections is controlled by the motorman by means of the master controller, which is similar in construction to the ordinary cylinder controller, and is handled in the same manner. Instead of effecting the motor combinations directly, however, this controller merely governs the operation of the motor controller.

The master controller operates a number of electrically operated switches or "contactors," which close and open the various motor and resistance circuits, and an electrically operated "reverser" that connects the field and armature leads of the motors to give the desired direction of movement to the car. Both the contactors and reverser are operated by solenoids, the operating current for which is admitted to them by the master controller.

Each motor- and trail-car is equipped with train cable, consisting of nine or ten individually insulated conductors connected to corresponding contacts in coupler sockets located at each end of the car. This train cable is connected identically on each motor-car to the master-controller fingers and the contactor and reverser operating coils, and is made continuous throughout the train by couplers between cars, connecting together corresponding terminals in the coupler sockets.

All wires carrying current supplied directly from the master controller form the "control circuit"; those carrying current for the motors form the "motor" or "power circuit."

Inasmuch as the motor-controller operating coils are connected to this control train line, it will be appreciated that energizing the proper wires by means of any master controller on the train will simultaneously operate corresponding contactors on all the motor-cars and simultaneously establish similar motor connections on all cars.

On account of the great flexibility of this system, it can be readily adapted to many classes of service other than that of train operation. The small space occupied by the master controller and the ease with which the controller may be operated make this system for heavy hoists desirable in some cases, or other classes of severe direct-current service requiring a controller easily manipulated, or one which may be located at a considerable distance from the motors.

All parts subject to wear are readily replaceable.

CONTACTORS

The contactors are the means of cutting in and out the various resistances, of making and breaking the main circuit between trolley and motors, and of changing from series to parallel connection.

Each contactor consists of a movable arm carrying a renewable copper tip which makes contact with a similar fixed tip, and a coil for actuating this arm when supplied with current from the master controller. The contactor is so designed that the motor circuit is closed only when current is flowing through its operating coil; and gravity, assisted by the spring action of the finger, causes the arm to drop and open this circuit immediately, when the control circuit is interrupted. Each contactor has an effective and powerful magnetic blow-out, which will disrupt the motor circuit under conditions far exceeding normal operation. In closing, the copper tips come together with a wiping action, which cleans and smooths their surfaces.

All contactors in an equipment are practically identical. and the few parts which are subject to burning and wear are so constructed as to be readily replaceable.

In order to save space and eliminate interconnections as much as possible, several contactors are mounted on the same base. The contactors should preferably be located under the car, and boxes are therefore supplied which facilitate installation, protect the contactors from brake-shoe dust and other foreign material, and provide the necessary insulation. These boxes are built with perforated openings for ventilation, but shields are supplied for closing these perforations whenever desirable.

REVERSER

The general design of the reverser is somewhat similar to the ordinary cylindrical motor reversing switch, with the addition of electro-magnets for throwing it to either forward or reverse position. In general construction, the operating coils are similar to those used on the contactors, but in order to secure absolute reliability of action in throwing, the coil is given full line potential. The reverser is provided with small fingers for handling control circuit connections, and, when it throws, the operating coil is disconnected from the ground and is placed in series with a set of contactor coils, thus cutting the operating current down to a safe running value. These coils are protected by a fuse, which will immediately open the circuit if the reverser fails to throw. If the position of the reverser does not correspond to the direction of movement indicated by the reverse handle on the master controller, the motors on that car cannot take current. While the motors are taking current the operating coil is energized, and the electrical circuits are interlocked to prevent possibility of throwing.

MASTER CONTROLLER

The master controller is considerably smaller than the ordinary street-car controller, but is similar in appearance and method of operation. Separate power and reverse handles are provided, as experience has led to the adoption of this arrangement in preference to providing for the movement of a single handle in opposite directions.

An automatic, safety, open-circuiting device is provided, whereby, in case the motorman removes his hand from the master-controller handle, the control circuit will be automatically opened by means of auxiliary contacts in the controller, which are operated by a spring when the button in the handle is released. This device is entirely separate and distinct in its action from that of the main cylinder. Moving the reverse handle either forwards or backwards makes connections for throwing the reverser to either forward or backward position. The handle can be removed only in the intermediate or off position. As the power handle is mechanically locked against movement when the reverse handle is removed, it is necessary for the motorman to carry only this handle when leaving the car.

When the master controller is thrown off, both line and ground connections are severed from the operating coils of important contactors, and none of the wires in the train cable are alive.

The current carried by the master controller is about 2.5 amperes for each equipment of 400 H.P. or less. This small current carrying capacity permits a compact construction, and the controller weighs only 130 pounds.

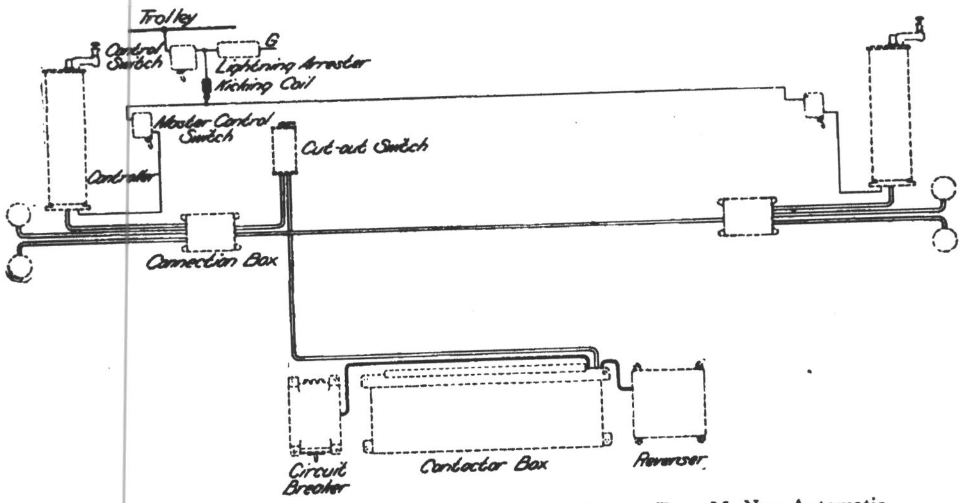

Trolley
Control Switch
G
Lightning Arrester
Kicking Coil
Master Control Switch
Cut-out Switch
Controller
Connection Box
Circuit Breaker
Contactor Box
Reverser

Fig. 1758—Diagram of Control Wiring for General Electric, Type M, Non-Automatic Multiple-Unit Control

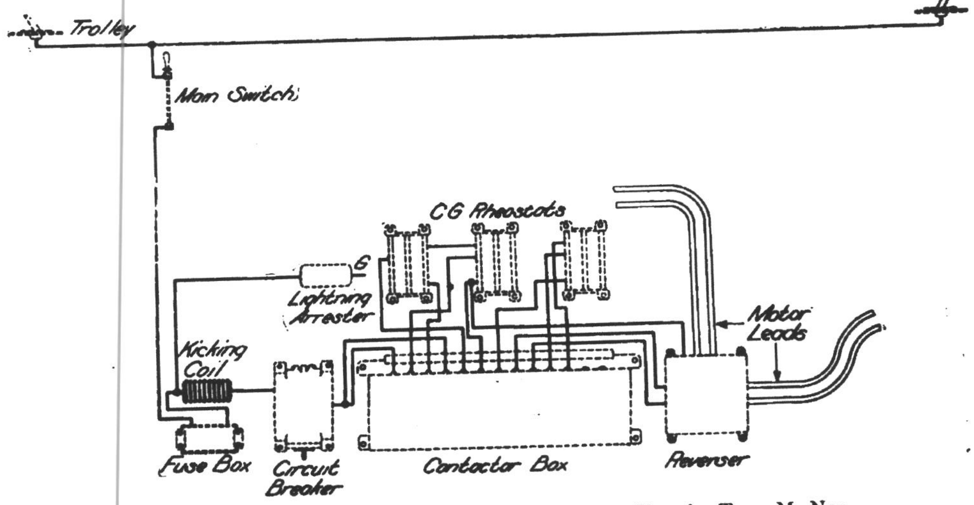

Trolley
Main Switch
CG Rheostats
G
Lightning Arrester
Motor Leads
Kicking Coil
Fuse Box
Circuit Breaker
Contactor Box
Reverser

Fig. 1759—Diagram of Motor Wiring for General Electric, Type M, Non-Automatic Multiple-Unit Control

SERIES RESISTANCE CONTACTS.	POSITION.	CONTACTORS.
	1	1, 2, 3, 11
	2	5
	3	6
	4	7
Series running position	5	10, 9, 8 All resistance out. Both motors in series.

MULTIPLE RESISTANCE CONTACTS.	POSITION	CONTACTORS.
	6	13, 12, 4, 2, 1 Both motors in parallel with resistance. Contactor 13 grounding field of No. 1 motor.
	7	6, 5
	8	7
	9	8
Multiple running position . . .	10	10, 9

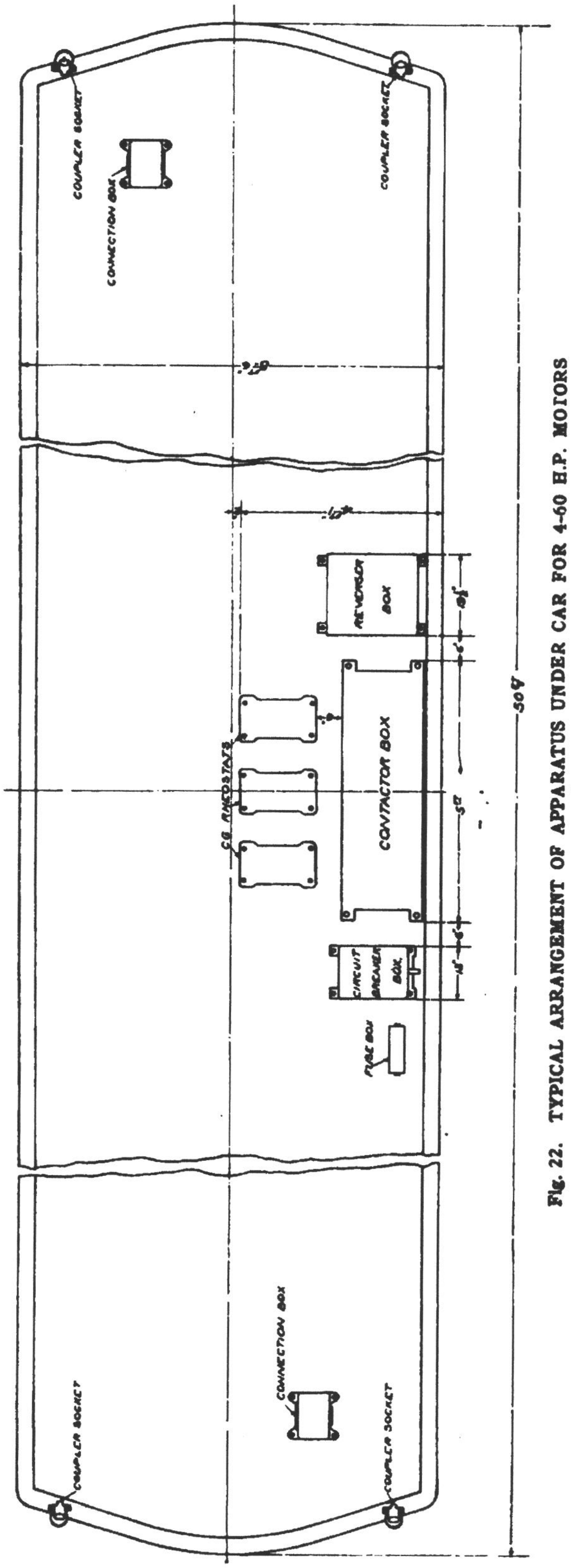

COUPLER SOCKET
COUPLER SOCKET
CONNECTION BOX
REVERSER BOX
CONTACTOR BOX
CG RHEOSTATS
CIRCUIT BREAKER BOX
FUSE BOX
CONNECTION BOX
COUPLER SOCKET
COUPLER SOCKET
6"
15"

Fig. 22. TYPICAL ARRANGEMENT OF APPARATUS UNDER CAR FOR 4-60 H.P. MOTORS

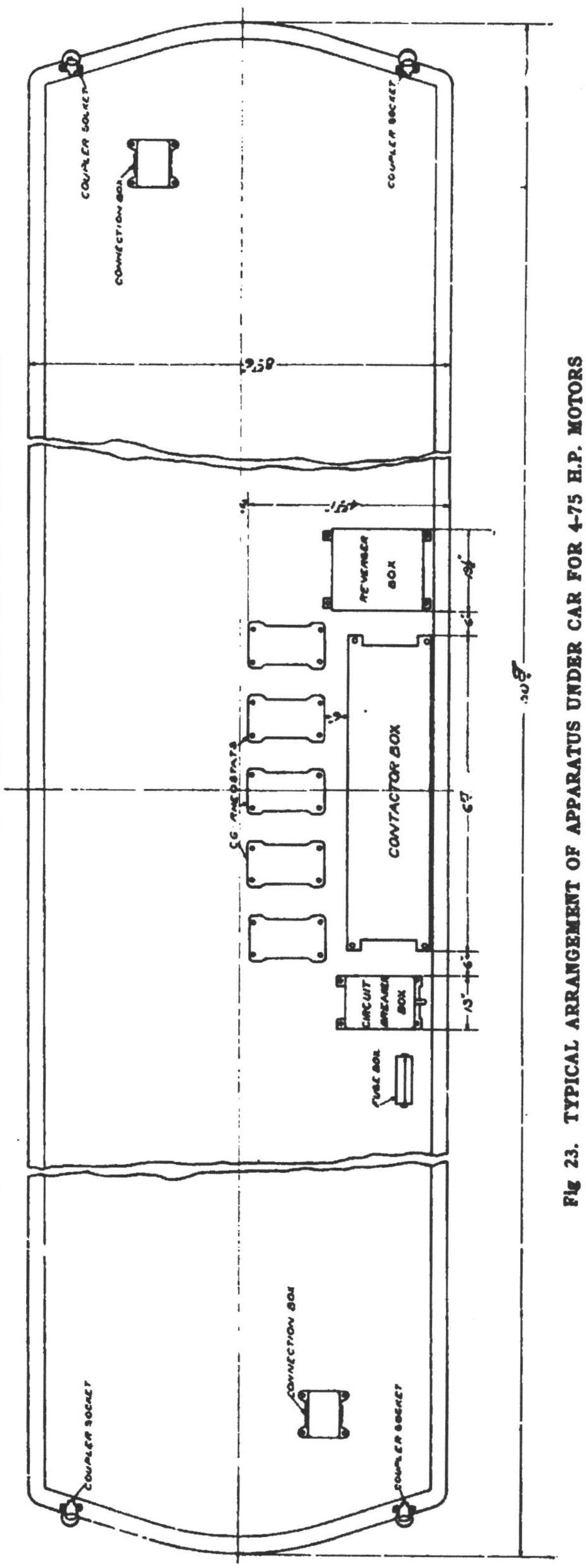
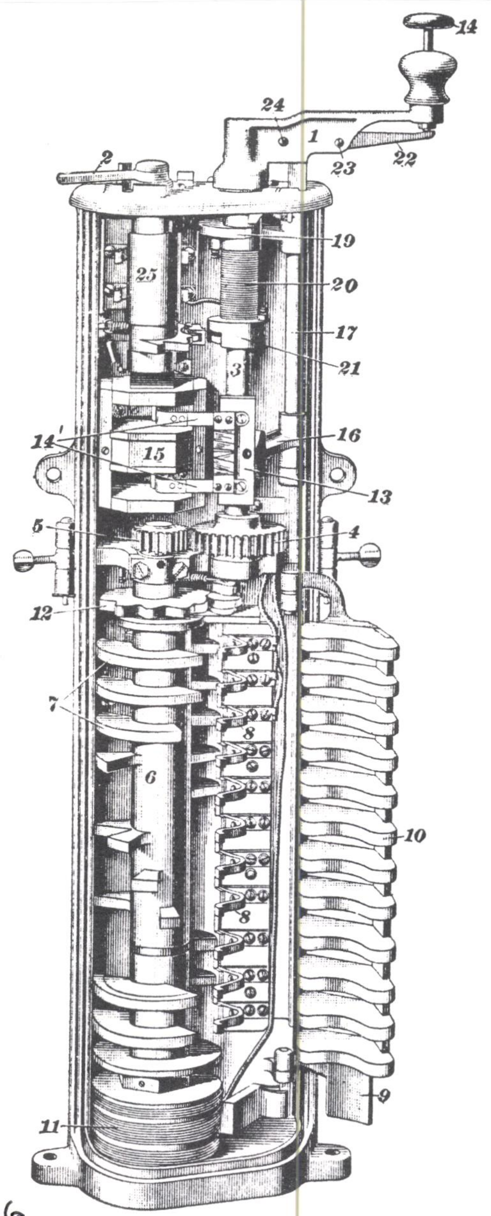

COUPLER SOCKET
COUPLER SOCKET
CONNECTION BOX
REVERSER BOX
CONTACTOR BOX
CG RHEOSTATS
CIRCUIT BREAKER BOX
FUSE BOX
CONNECTION BOX
COUPLER SOCKET
COUPLER SOCKET
6"
15"

Fig 23. TYPICAL ARRANGEMENT OF APPARATUS UNDER CAR FOR 4-75 H.P. MOTORS

Digitized by Google


14
24
1
2
23
22
19
25
20
17
3
21
14'
15
16
13
5
4
12
7
8
6
10
8
9
11

C-6

A master controller for General Electric Type M multiple-unit control.

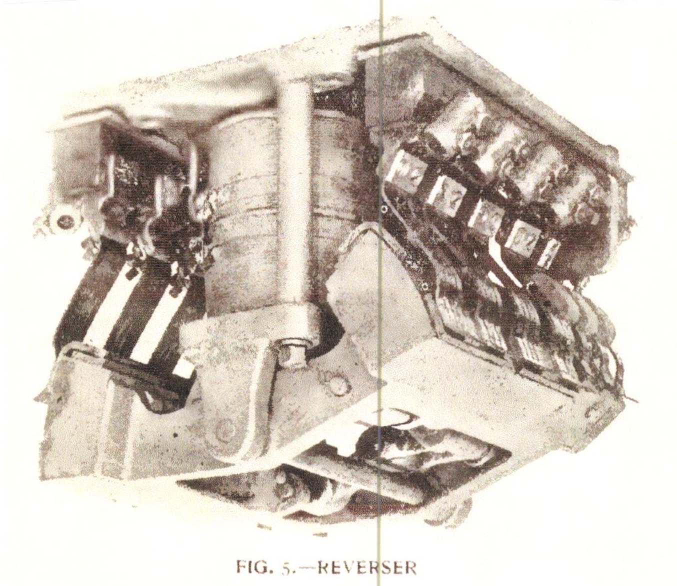


FIG. 5.—REVERSER

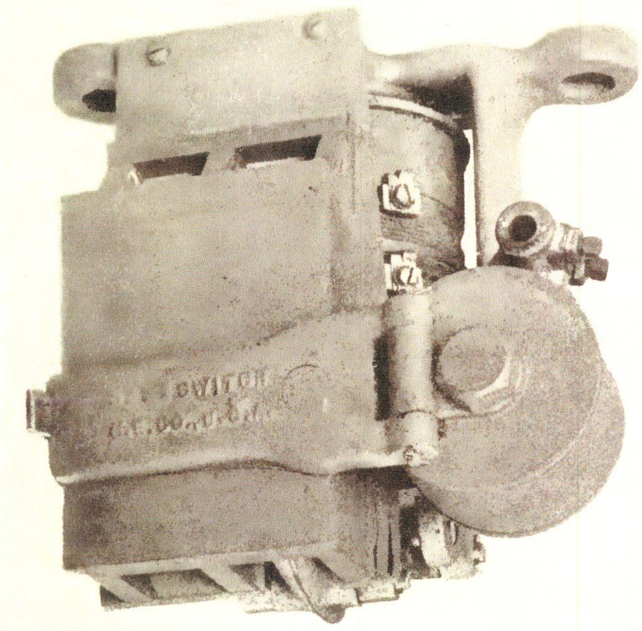


FIG. 3.—CONTACTOR

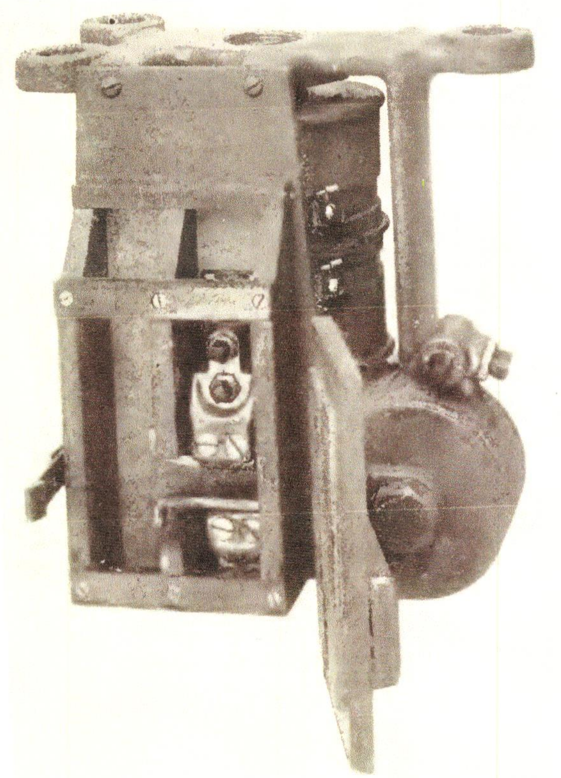
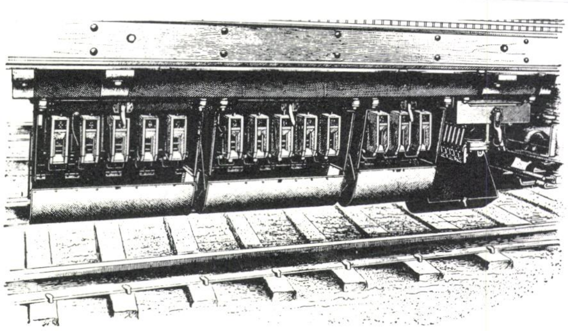
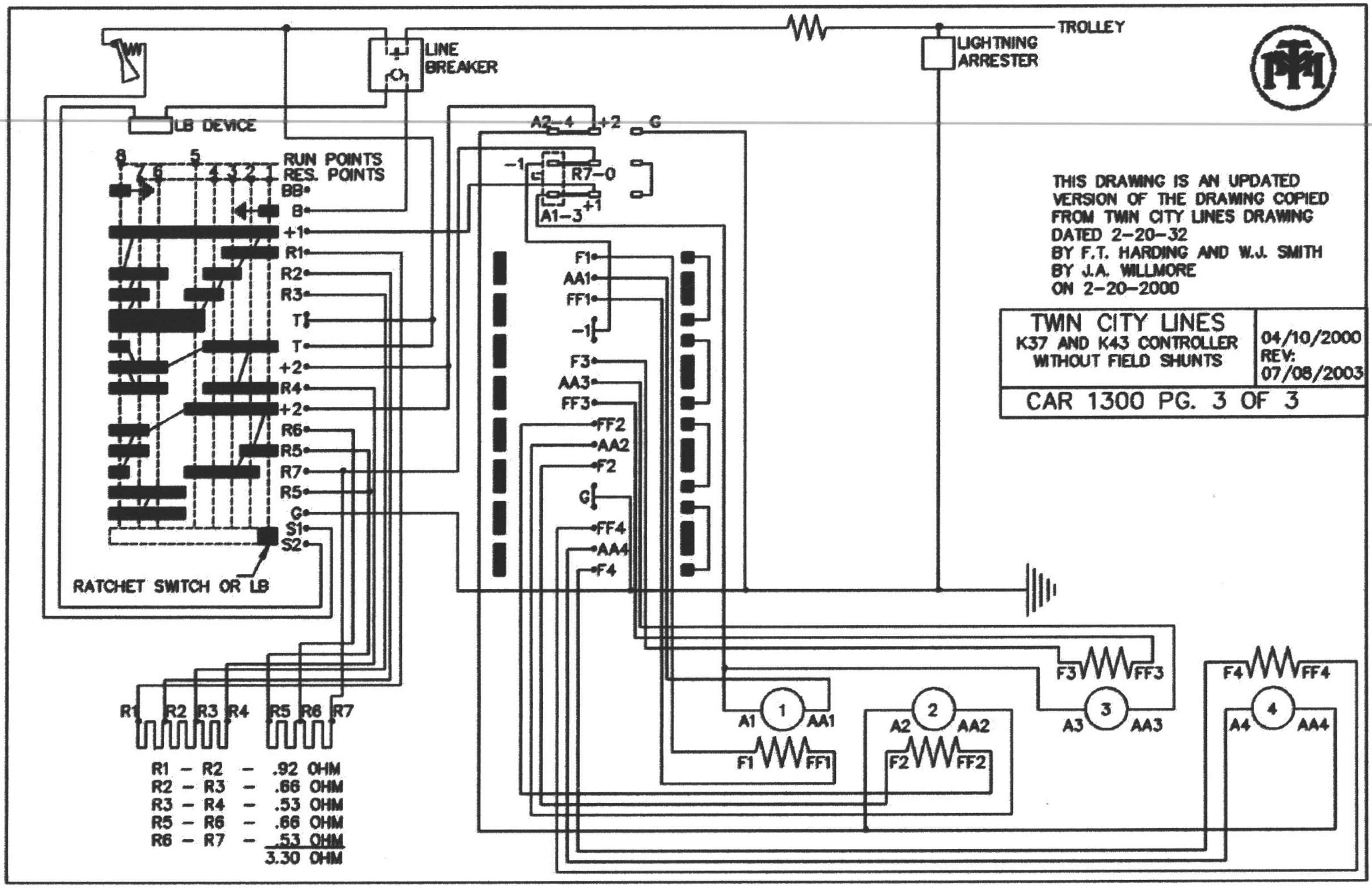


FIG. 4.—CONTACTOR POINTS OPEN FOR INSPECTION



Type M control contactors and reverser (right) mounted under a car floor.

AVERY
PV119ED


TROLLEY
LINE BREAKER
LIGHTNING ARRESTER
LB DEVICE
8
5
7
6
4
3
2
1
RUN POINTS
RES. POINTS
BB
B
+1
R1
R2
R3
T
T
+2
R4
+2
R6
R5
R7
R5
G
S1
S2
RATCHET SWITCH OR LB
A2-4
+2
G
-1
R7-0
A1-3
+1
F1
AA1
FF1
-1
F3
AA3
FF3
FF2
AA2
F2
G
FF4
AA4
F4
1
A1
AA1
F1
FF1
2
A2
AA2
F2
FF2
3
A3
AA3
F3
FF3
4
A4
AA4
F4
FF4
R1
R2
R3
R4
R5
R6
R7

R1 - R2 - .92 OHM
R2 - R3 - .66 OHM
R3 - R4 - .53 OHM
R5 - R6 - .66 OHM
R6 - R7 - .53 OHM
3.30 OHM

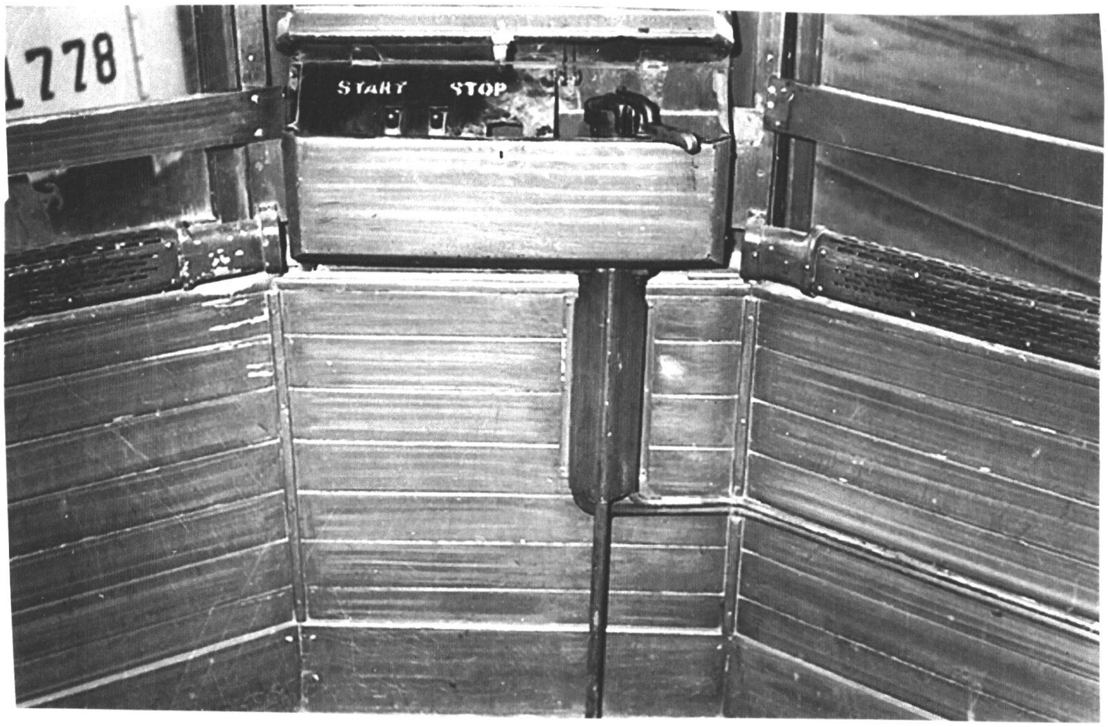
THIS DRAWING IS AN UPDATED
VERSION OF THE DRAWING COPIED
FROM TWIN CITY LINES DRAWING
DATED 2-20-32
BY F.T. HARDING AND W.J. SMITH
BY J.A. WILLMORE
ON 2-20-2000

TWIN CITY LINES
K37 AND K43 CONTROLLER
WITHOUT FIELD SHUNTS

04/10/2000
REV:
07/08/2003

CAR 1300 PG. 3 OF 3

BACK-UP CONTROL FOR ONE MAN CARS


1778
START
STOP

CAR WEIGHTS

Diagram of Weight Distribution on Car Axles
Tracing dated 9-13-1899

[Listed in the sequence the diagrams appeared on the tracing]

	Weight (Lbs.)
TCRT Vestibuled Car Brill Trucks-Four Motors	18,000
#771 Carbody	3,456
Air brakes and equipment	11,808
4 GE 57 Motors	12,656
2 Brill Trucks	46,000

TCRT Vestibuled Car Brill Trucks-Two Motors	18,000
#771 Carbody	3,456
Air brakes and equipment	5,944
2 GE 57 Motors	12,656
2 Brill Trucks	40,056

American Vestibuled Car Bemis Maximum Traction Trucks-Two Motors	16,400
Carbody	5,368
2 WP Motors	9,232
2 Bemis Trucks	31,000

Large Snow Plow Bemis Truck 7.5' Wheelbase-Four Motor Equipment	34,000
Weight on front truck	31,170
Weight on rear truck	65,170

Small Snow Plow Bemis Truck 5.5' Wheelbase-Four Motor Equipment	44,000
Weight equally distributed	

Duluth-Superior TCRT Co.'s Car Brill Truck 5.8' Wheelbase-Four Motors	18,000
Carbody and equipment	9,540
4 GE 67 Motors	12,140
2 Brill Trucks	39,680

Car Wiring Diagrams

G59#3	3-11-1899	Two G.E. 57 Motors and K-11 Controller 40 ft. Vestibuled Car: one motor on each truck
G60#3	3-22-1901	Four G.E. 57 Motors and K-14 Controller
G61#3	3-13-1901 Added notation:	K-6 Control and 4 G.E. WP Motors Cars wired like G.E. Co.'s diagram 775-788 818 610-612,614,616,619,621-622,624-625

Drawing of exterior of G.E. 57 Motor dated 10-19-1900.

Data on Car Equipment
Tracing Dated 5-23-1901

[Listed in the sequence the information appeared on the tracing]

	Body	Motors	Trucks	Total
42′6″ American Vestibuled Brill Old 5′8″/4 WP50/K-6	17375	12112	12140	41627
42′6″ American Vestibuled Rebuilt Brill Old 5′8″/4 WP 50/K-6	17250	12112	12140	41502
43′2 ½″ TCRT 1899 Pattern Air brakes TCRT C.B. 5′0″/4 GE 57/K-14	22236	12320	12164	46720
43′2 ½″ TCRT 1899 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	20226	9540	12164	41930
43′2 ½″ TCRT 1899 Pattern Brill Old C.B. 5′8″/4 WP 50/K-6	19348	12112	12140	43800
43′2 ½″ TCRT 1900 Pattern Brill New 5′8″/4 GE 67/K-6	19338	9540	11492	40370
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	18050	9540	12004	39594
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 WP 50/K-6	18050	12112	12004	42166
37′5″ TCRT 1901 Pattern Bemis 5′1″/2 WP 50/TH	15250	5686	9564	30500
37′5″ TCRT 1901 Pattern Bemis 5′2″/2 GE 57/K-11	15342	6160	9564	31066
41′7″ American Open (both motors on rear truck) Bemis M.T. 5′2″/2 WP 50/TH	11250	5686	9564	26500
37′0″ Northern Open (both motors on front truck) Bemis M.T. 5′2″/2 WP 50/TH	10550	5686	9564	25800
43′2 ½″ TCRT 1899 Pattern Brill New C.B. 5′8″/4 GE 67/K-6	20858	9540	11492	41890
"Jumbo" Snow Plow Bemis C.B./4 WP 50/TH				64500
42′6″ American Vestibuled Brill Old C.B. 5′8″/4 WP 50/K-6	17300	12112	12140	41702
43′2 ½″ TCRT 1899 Pattern Air brakes TCRT C.B. 5′0″/4 GE 57/K-6 (sic)	[no weights listed]			
43′2 ½″ TCRT 1899 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	20070	9540	12164	41914
43′2 ½″ TCRT 1899 Pattern Brill Old C.B. 5′8″/4 WP 50/K-6	20070	12112	12140	44462
43′2 ½″ TCRT 1899 Pattern Brill New C.B. 5′8″/4 GE 67/K-6	20070	9540	11492	41242
43′2 ½″ TCRT 1900 Pattern Brill New C.B. 5′8″/4 GE 67/K-6	19270	9540	11492	40442
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 GE 67/K-6	19270	9540	12164	41114
43′2 ½″ TCRT 1900 Pattern TCRT C.B. 5′0″/4 WP 50/K-6	19270	12112	12164	43686

1898		1900		1905	1110-1111
Body	18,000	Body	18,000	Body	19,980
2 WP 50	5,368	2 WP 50	5,368	4GE70/K28	12,300
2 Bemis	9,232	2 Twin City	12,164	BLW #1	15,720
Total	32,600	Total	35,532	Total	48,000
1899		1901		1928	2006-2030
Body	18,000	Body	18,000	Body	12,100
2 GE 57	5,944	4 GE 57	11,888	Equipment	7,738
2 Bemis	9,232	2 Brill 27A	12,656	Trucks	8,200
Total	33,176	Air Brakes	3,456	Total	28,038
		Total	46,000		
1899					
Body	18,000	1901		1945	PCC
2 GE 57	5,944	Body	18,000	Body	20,785
2 Brill 27A	12,656	4 GE 57	11,888	Elect Equip	1,780
Total	36,600	2 Twin City	12,164	Motors	3,480
±Air Brakes	3,456	Air Brakes	3,456	Trucks	11,720
Total	40,056	Total	45,508	Total	37,765
				300-339	37,990

Equipment Data Sheets
As Built and Rebuilt with Front Exits
(Trucks abbreviated)

Private Car	49,000	
737-751	45,800 with Brill 02/4 WP50/K-6	
752-772	44,400 with Brill 02 or TC/4 GE67/K-6	
773-785	47,600 with TC/4 GE57/K-14 Stillwater Division	
786-788, 797-816	44,600 with TC/4 GE67/K-6	
817-831	44,400 with TC/4 WP 50/K-6	
832-867	42,900 with Brill 01/4 GE 67/K-6	
868-899	40,200 with Brill 02/4 GE 67/K-6	
900-904	42,600 with Brill 02/4 GE 67/K-6	
905-941	46,400 with Brill 03/4 GE 67/K-6	
942-946	46,500 with Brill 03/4 GE 67/K-6	
947-951	46,500 with BLW 1/4 GE 67/K-6	
952-954	46,700 with BLW 1/4 GE 67/K-6	
955-975, 981-991	46,700 with BLW 1/4 GE 70/K-28	45,700?
976-980	43,600 with Brill 02/4 GE 67/K-6	
992-1041	47,300 with Brill 04/4 GE 70/K-28	Same with TC 8/4 GE 70/K-28
1042-1087	46,700 with BLW 1/4 GE 70/K-28	
1088-1107	47,300 with BLW 1/4 GE 70/K-28	1092 with Double Deck: 52,000
1112-1123	59,000 with BLW 2/4 GE 73/C-6	
1124-1142	46,700 with BLW 1/4 GE 70/K-28	
1143-1144	48,300 with BLW 5/4 GE 70/K-28	

1145	60,400 with BLW2/73/C6.	65,400 ? as double-deck, or 70,900 ?
1146-1163	60,400 with BLW4/73/C6.	
1164-1188	51,000 with BLW1/70/K28 and BLW4/216/K37.	Mar 1930: 1164-1192 50,400 TC8/70/K28.
1189-1220	49,600 with BLW5/70/K28 and BLW1/70/K28.	
1221-1254	49,000 with BLW5/70/K28.	
1255-1265	58,900 with BLW4/73/C6.	
1266-1290	49,200 with BLW5/70/K28 and BLW5/213/K37.	
1291-1309	47,800 with BLW5/213/K37.	
1310-1359	48,000 with TC5/213/K37.	
1360-1379	46,800 with TC5/213/K37 and BLW4/216/K37 and TC5/216/K37.	
	Front exit 1371-1375 45,600 with TC8/213/K37.	
	Front exit 1376-1379 48,800 with TC5/213/K37.	
1380-1479	46,200 with TC6/216/K37.	
1480-1481	46,800 with TC8/216/K37.	Mar 1930: 44,400 (sic) with same equipment.
1482-1577	43,700 with TC8/216/K37.	
1578-1685	42,100 with TC8/203/K37.	Front exit 1620 41,800 with TC8/200/K43.
		Front exit 1600-1625 42,300 with TC9/200/K43.
1686-1854	41,700 with TC9/200/K43.	
2000-2001	28,000 (We have another figure as rebuilt: 30,680.)	
2002-2003	26,800 Rebuilt: 2002 28,800; 2003 28,500.)	
1-4	24,400	
2004-2005	29,480	
2006-2030	28,400	

1254,1266-1328 rebuilt front exit 1928: 46,140 with TC9RB/203/K43.
1129 rebuilt double-end: 49,000
1230 rebuilt double-end: 48,700
3 rebuilt double-end: 27,400

Rebuilt for One/Two Man Operation
1931-1934

1293-1328	45,560/46,460 with TC9RB/203G/K43F2.
1382,1384-1398,1402,1408	47,100 with TC5/213/K37C.
1415,1417,1420,1425,1430,1433,1437,1440,1441,1446, 1448-1451,1454,1462,1464	46,700 with TC6/216/K37C.
1468,1473	47,800 with TC6/216/K37C.
1465-1467,1469,1470,1475,1479,1480,1482,1485,1488,1489, 1492,1494-1499,1501-1513,1515,1517-1541,1543-1546	47,100 with TC6/216/K37C.
1548-1554,1556-1562,1564-1593,1603-1644	46,700 with TC8/216/K37C.
1594-1602	46,700 with TC8/203/K37C.
1659-1668	44,720 with TC9/200/K37.
1645-1658,1669-1854	44,720 with TC9/200/K43F2.

1935

1219-1229,1233,1235-1253	48,700 with TC5/213/K35.

1936-1937

1166-1201,1203,1205-1211,1213-1218	44,651 with TC8RB/203Q/K35.

1942

1487,1490,1491,1500,1516	47,100 with TC6/216/K37C.

AVERY POLY VU

CAR WEIGHTS
SERVICE EQUIPMENT

2	Supply Car (762)	43,800	
3-5	Wire Cars	59,000	
7-10	Work Cars	39,280	
11-12	Work Cars	42,600	
13-16	Work Cars	40,300	
17-19	Work Cars	41,100	
20	Locomotive	78,500	(includes 34,000 ballast)
21	Wrecker-Crane	78,600	(another source 87,400)
22	Snow Plow	65,400	
23-24	Snow Plow-Sweepers	75,400	
25	Snow Plow	37,000	
26-28	Shifters	17,600	26 and 28 as rebuilt 17,500
29-32	Snow Plow-Sweepers	73,400	
33	UGWC Work Car	39,800	
34	Baggage Car	54,540	
35	Rail Grinder	?	
36-38	Snow Plows	65,400	
39-40	Rail Grinders	?	
43-45	Sand Cars	50,000	
46-48	Work Cars	41,000	
49	Refuse Car	40,000	
50	Crane Car	60,600	As rebuilt 77,100
51-56	Work Cars	40,040	
57,60	Shovels	56,000	
58	Cupola Car	51,000	As rebuilt 42,860
59	Sprinkler Car	52,100	
61	Cupola Car	51,240	As rebuilt 42,860
62-63	Work Cars	43,740	
64-69	Work Cars	43,320	
70	Sand Blast Car	13,980	
72	Wire Car	59,000	
73	Shovel	56,000	
74	Yard Crane	?	
75-82	Snow Plows	64,320	
83	Crane Car	67,000	
95	Supply Car (1134)	46,700	
96	Rail Grinder (1261)	67,600	
97	Supply Car (1349	48,000	
UofM	Switch Car	46,700	
StPS	Work Car/Snow Plow	56,200	

MSR and SPCR Valuations by A L Drum & Co.
January 1, 1922

Trucks (with one pair standard TCL Scrapers)	**Weight**
Bemis single truck	4,500
Bemis double truck	8,400
Brill 27-A2	13,714
Brill 27-E2	14,214
Twin City	13,814
Baldwin #1 and #5	13,014
Baldwin #2 and #4	16,794
Twin City #6	12,814
Twin City #7	12,614
Twin City #8	12,214
Twin City #9	11,414

Motors and Controllers	**Weight**
2GE67/K-11	6,200
2WP50/K-11	6,485
4WP50/K-6	12,504
4WP50/K-14	11,850
4GE57/K-6	12,785
4GE57/K-14	13,000
4GE57/Type M C-6	14,650
4GE67/K-6	10,834
4GE67/K-14	11,275
4GE67/K-28-A,K-28-B	10,774
4GE70/K-6	11,360
4GE70/K-28-A,K-28-B	11,300
4GE70/K-37,K-37-A,K-37-C	11,580
4GE73/Type M C-6	19,450
4GE73/Type M two C-6 (Snow Plow-Sweepers)	20,215
4GE213/K-37,K-37-A,K-37-C	12,360
4GE213/K-43-F2	12,120
4GE216/K-37,K-37-A,K-37-C	12,360
4GE216/K-43-F2	12,120
4GE203G/K-37-C	11,580
4GE203G/K-43-F2	11,340
4GE203O/K-37,K-37-C	11,580
4GE203O/K-43-F2	11,340
4GE200H/K-37-C	11,220
4GE200H/K-43-F2	9,980

TRUCK SURVEY
6-1-1954

Twin City #6

In Service: 1166,1219,20;1382;1468,99;1546,59;1621,25,28.

At Shops (assume some TC#5): 1223,33,36,40,46,48-53;1389;1402,70,82;1525,44, 1549,90,99;1616,17,39.

Twin City #8

At Shops: 1511,36;1619.

Twin City #8RB

In Service: 1216.

At Shops: 1170,78,80-85,90,92,93;1210,15.

Twin City #9

In Service: 1301,06,24;1665,71,78,82,86,94;1746,56,62,67,75,82,84,88,95,97; 1807,20,27,45,46,48.

At Shops: 1309,12,15;1615,37,72,75,76;1700,01,06-08,20,27,33,44,52,55,65,90; 1801.

Twin City #9RB

In Service: 1294,97,98;1300,02-04,07,10,11,13,16,19,20,22,23,26-28;1789; 1817,19,49,54.

At Shops: 1266,69,70,96;1305,21;1761.

SERVICE EQUIPMENT

Twin City Work Car: 45,49,50.

Twin City #6: 3,15,63,72.

CONTENTS OF
BACK POCKET

Truck Identification Photos

762 Roll destination sign: 7th Street. Twin City trucks. Air brakes. (after 1903

764 Side board destination sign: Como-Interurban-Harriet. Twin City trucks. (1901?)

766 Side board destination sign: Como-Interurban-Harriet. Brill Old trucks. Heater not relocated. All cross seats. Wood trolley pole; #6 trolley base. (1899 -1900)

777 Side board destination sign: Como-Interurban-Harriet (Minnehaha Falls also). Brill 01 trucks with scrapers. Heater not relocated. Looks like T-H rheostat controller (no underbody equipment). Wood trolley pole; #6 trolley base. (1901) At 31st. Station. Photo for publicity purposes only?

769 Roll destination sign: Inver Grove. Twin City trucks, K-6 controller. Air brakes. Inver Grove line opened 8-1-1905. Note small arc headlight using same type of receptacles as the large arc headlights on Stillwater Division cars. ~~Speculation: 768-774 were the cars with Brill Old trucks, 2 G.E. 57 motors, K-11 controllers, for the St.Paul-Stillwater line~~.